[H.A.S.C. No. 99-36]

# DEFENSE DEPARTMENT AUTHORIZATION AND OVERSIGHT

HEARINGS



ON

# H.R. 4428

DEPARTMENT OF DEFENSE AUTHORIZATION OF APPROPRIATIONS FOR FISCAL YEAR 1987

AND

OVERSIGHT OF PREVIOUSLY AUTHORIZED PROGRAMS

BEFORE THE

COMMITTEE ON ARMED SERVICES
HOUSE OF REPRESENTATIVES

NINETY-NINTH CONGRESS

SECOND SESSION

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TITLE I—PROCUREMENT OF AIRCRAFT, MISSILES, WEAPONS AND TRACKED COMBAT VEHICLES, AMMUNITION, AND OTHER PROCUREMENT

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HEARINGS HELD
FEBRUARY 18, 24, 25, 26, 27; MARCH 3, 11, 12, 18, AND MAY 21, 1986

**STATEMENT OF GEN. MAXWELL THURMAN, VICE CHIEF OF STAFF, DEPARTMENT OF THE ARMY, ACCOMPANIED BY LT. GEN. LOUIS C. WAGNER, JR., DEPUTY CHIEF OF STAFF FOR RESEARCH, DEVELOPMENT AND ACQUISITION, DEPARTMENT OF THE ARMY; MAJ. GEN. FREDERIC J. BROWN, COMMANDING GENERAL, U.S. ARMY ARMOR CENTER, FORT KNOX, KY; MAJ. GEN. EDWIN H. BURBA, JR., COMMANDING GENERAL, U.S. ARMY INFANTRY CENTER, FORT BENNING, GA, AND LT. COL. WILLIAM H. JANES, COMMANDER, 1-73RD ARMOR (OPPOSING FORCE) NATIONAL TRAINING CENTER, FORT IRWIN, CA**

General THURMAN. Thank you very much, Mr. Chairman. We welcome the opportunity to report to the committee on the Bradley fighting vehicle and to support the fiscal year 1987 procurement request for 870 Bradleys. The Army wants the Bradley and the Army needs it, and I will address myself to that need. I ask you to include in the record my statement, sir, which has been furnished to the committee. Then I would like to use some charts to carry on the dialog this afternoon.

Mr. STRATTON. Without objection, your statement will appear at this point in the record and you may proceed with the charts.

General THURMAN. Thank you, sir. You have introduced my squad here. Lou Wagner, as you know, is the Deputy Chief of Staff for Research, Development and Acquisition. Ed Burba is the commander of the Infantry School at Fort Benning. General Brown is the commander of the Armor School. We have one unusual person, Lt. Col. Bill Janes, who usually appears in a Soviet uniform at the National Training Center, where he commands the armored forces that fight both the current suite of weapons systems and the improved suite of weapons. The committee might be interested in hearing it from a person who understands Soviet tactics and practices them everyday.

# BRADLEY FIGHTING VEHICLE HEARING
# 18 FEBRUARY 1986
# PROCUREMENT SUBCOMMITTEE, HASC

GENERAL MAXWELL R. THURMAN

- THE BRADLEY FIGHTING VEHICLE
  - CONTINUUM OF REQUIREMENTS
  - VULNERABILITY TESTING
  - ALTERNATIVES CONSIDERED OVER TIME
  - 1987 PROCUREMENT REQUEST

## THE BRADLEY REQUIREMENT

- LONG RANGE WEAPONS CAPABILITY, NIGHT AND DAY, UNDER ARMOR, AGAINST TANKS LIGHTLY ARMORED VEHICLES (PARTICULARLY THE BMP), AND DISMOUNTED TROOPS
- MOBILITY COMPATIBLE WITH TANKS
- STABILIZED CANNON/MACHINE GUN (SHOOT ON THE MOVE CAPABILITY)
- PROTECTION AGAINST ARTILLERY, AUTOMATIC WEAPONS AND SMALL ARMS
- CAPACITY TO CARRY A SQUAD AND ITS EQUIPMENT FOR DISMOUNTED OPERATIONS
- SWIM CAPABILITY

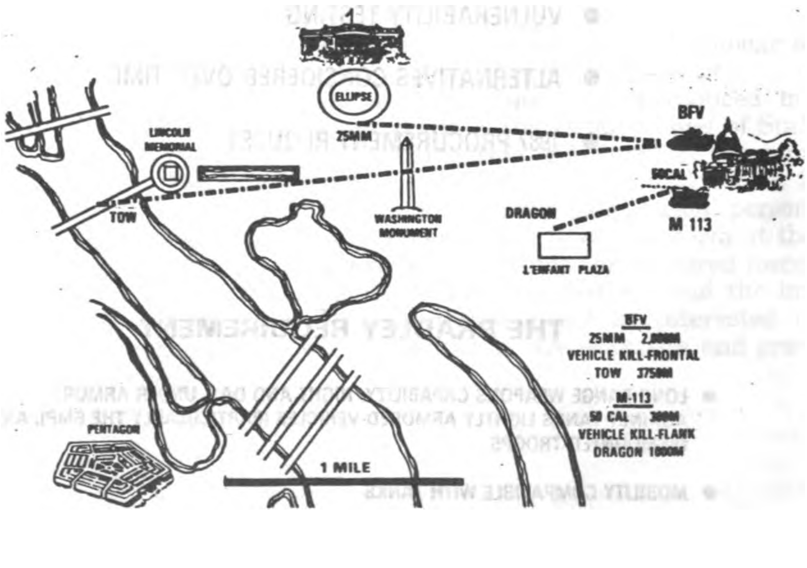
NOTE: ORIGINAL REQUIREMENT DOCUMENT 1968
RATIFIED BY CRIZER REPORT, 1978, PAGE I-4
FUNDED FOR PRODUCTION 1979

*REQUIREMENTS MET – PRODUCTION – 2085 IN SERVICE*

Let's review on the chart to your right as we will talk to those. Go to the chart which describes the Bradley requirement. We are operating on a maneuver warfare scheme where the essence of maneuver warfare is fire and maneuver. You have got to have round the clock operations, a combined arms system of infantry, armor, artillery, and air support, where one on one duels will not win you a war, particularly if the threat outnumbers you.

Those are the Bradley requirements that were in the 1968 documents. They were ratified by the Crizer report of 1978, illuminated at the bottom there, page N-4; and then funded for production. All those are the same requirements that we have in the series of documents. The requirements have been met to date, the system is in production, and there are 2,085 of those currently in service in the U.S. Army.

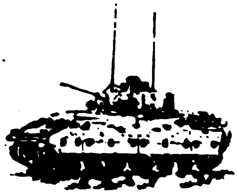
**MAXIMUM EFFECTIVE RANGES**
**M-113 — BFV**




A reminder of the effective ranges of the weapon, we are talking about. It is located here in the Nation's Capitol with its antecedent, the M-113, and the M-113, as you see, has a range of 1,000 meters with its antitank weapon, whereas the Bradley fighting vehicle reaches out all the way to the Memorial Bridge with a 3,750 meter TOW missile system, or with its 25mm cannon, 2,000 meters.

## BRADLEY FIGHTING VEHICLE

BRADLEY IS NOT A TANK...



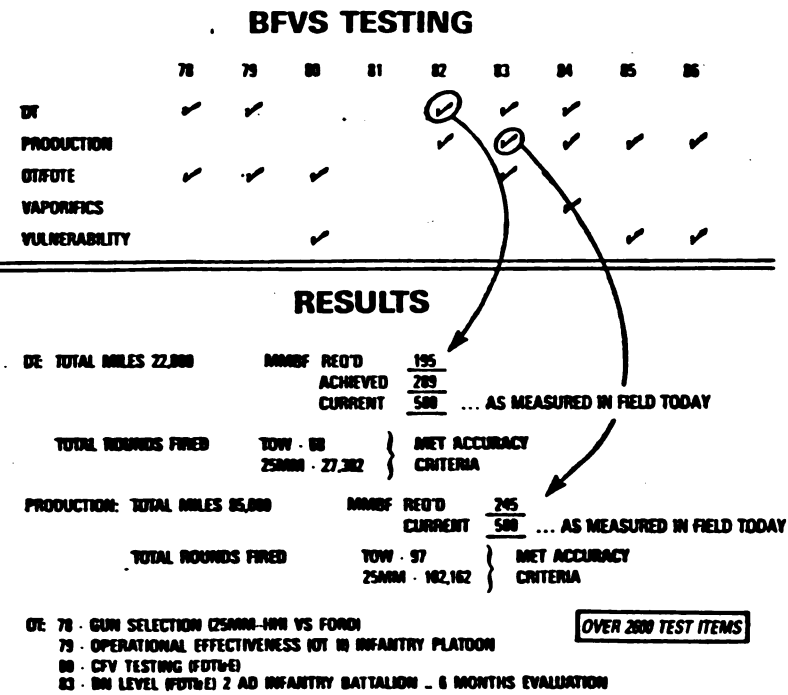
NOR MERELY A PERSONNEL CARRIER

**BRADLEY:**

- IS VULNERABLE AS ARE ALL SEA, AIR AND LANDSHIPS
- HAS THE KEYS TO SURVIVAL ON THE LETHAL BATTLEFIELD, NAMELY:
  - ATGM TANK KILLING CAPABILITY
  - OUTRANGE TANK CANNONS
  - FIRES FROM DEFILADE
  - THERMAL SIGHTS - NIGHT/SMOKE
  - IMPROVED ARMOR VS M113
  - STABILIZED GUNS
  - AGILITY AND SPEED
  - FIRING PORT WEAPONS
  - SMOKE GENERATOR AND GRENADE LAUNCHERS
- WILL SURVIVE WHEN USED BY TACTICALLY COMPETENT LEADERS AND WELL TRAINED SOLDIERS

This chart shows you that the Bradley fighting vehicle is not a tank, nor is it merely a personnel carrier. It is vulnerable, but that doesn't mean that it is not survivable. Survivability on the battlefield, whether you are a foot soldier or a mechanized soldier, depends on agility; whether you are on foot or in a vehicle dashing across open ground; reducing exposure, whether you are armored or not; whether you are wearing a flack vest or laminate of steel or aluminum, the use of terrain crawling if you are an infantryman, keeping your head down, or your vehicle in hull defilade if you are armor. Tactics of fire and manuever in night and day operations, with firepower the best way to survive, kill the other guy before he kills you, and at a greater range if possible.

Those are all qualities now associated with the Bradley fighting vehicle.




This chart swings into our test results, and I would simply point out this chart represents a continuum of testing since we began it in 1978, and as we continue it into 1986. I have illuminated a couple of items there. Under the development tests in 1982 there were 251 items tested and, for example, the mean miles between failure was required to be 195 miles. It actually achieved 289 and currently, as measured in the field today, we are getting 580 miles, which means it is operating well in the field. Production testing had another three hundred items, and showed it continued to do very well, currently 580. So there have been over 2,600 items tested on this vehicle in a variety of ways over a period of time, and you will note vaporifics at the top of the chart, vaporifics in 1984 and vulnerability in 1980, 1985, and 1986. Those are sort of the heart of the current discussion about the Bradley.

## "VAPORIFIC" — OVERPRESSURE TESTING 1984 DATA

**VAPORIFICS: RAPID OXIDATION OF FINELY DIVIDED METALLIC PARTICLES WHICH PRODUCES PRESSURE, HEAT, GASES AND LIGHT**

**THREAT WEAPONS**

- RPG-7
- TOW
- 105 MM HEAT

- OVERPRESSURES WERE NOT OF SUFFICIENT MAGNITUDE TO PRODUCE CASUALTIES
- TEMPERATURES DID NOT ENDURE LONG ENOUGH TO PRODUCE SECOND DEGREE BURNS
- NO SIGNIFICANT CONCENTRATION OF NITROUS OXIDE, NITROGEN DIOXIDE

***FURTHER TESTING ON TOXICITY IN NEXT SERIES***

So let's go first to the vaporific chart, which has to do with overpressure testing. I put a definition on there—rapid oxidation of finely divided metallic particles which when hit by a high explosive antitank round produces pressure, heat, gases and light inside the vehicle or on the outside, for that matter. We tested the Bradley against those weapons, the RPG, TOW and 105, all of which are overmatched weapons against the Bradley. That is, it was not designed to withstand those shots, but nonetheless, we tested those, and you get the results that you see there.

The overpressures were not of sufficient magnitude to produce casualties. This is one of the elements of interest between us and some analysts, who say that if you rupture eardrums that is a casualty. We believe it is not. My colleague, General Wagner, seated beside me, got his eardrum blown out while on an armored personnel carrier and went on in the same engagement to win the Distinguished Service Cross. It obviously doesn't totally impair you, though it may be temporarily discomforting.

We found that the high temperature does not endure long enough to produce second degree burns.

The last issue is still controversial on the significant concentration of nitrous oxide, in order to make sure that we put everything to rest on this issue, because it is complicated, and because in this you get the halon fire extinguisher effects. We have included a more thorough and rigorous test for phase 2, which has been submitted to the Department of Defense for their approval. Incidental-

ly, the Department of Defense approved the previous test plan that I will now describe, the vulnerability testing.

## VULNERABILITY TESTING

- REQUIREMENTS (MET IN 1980 TESTING)
  - SMALL ARMS — LOW PROBABILITY OF PENETRATION
  - HEAVY MACHINE GUNS — (SAME)
  - ARTILLERY — (SAME)
  - MINES — (SAME)
- UNCERTAINTY - OVERMATCHING WEAPONS
  - ADEQUACY OF FIRE SUPPRESSION SYSTEM
  - OCCURENCE OF SECONDARY FIRES
  - EFFECTS OF OVERPRESSURE AND TEMPERATURE
  - EFFECTS OF PENETRATION AND SPALL ON VEHICLE/CREW
  - EFFECTS OF SPALL ON AMMUNITION
  - VERIFICATION OF MODELS

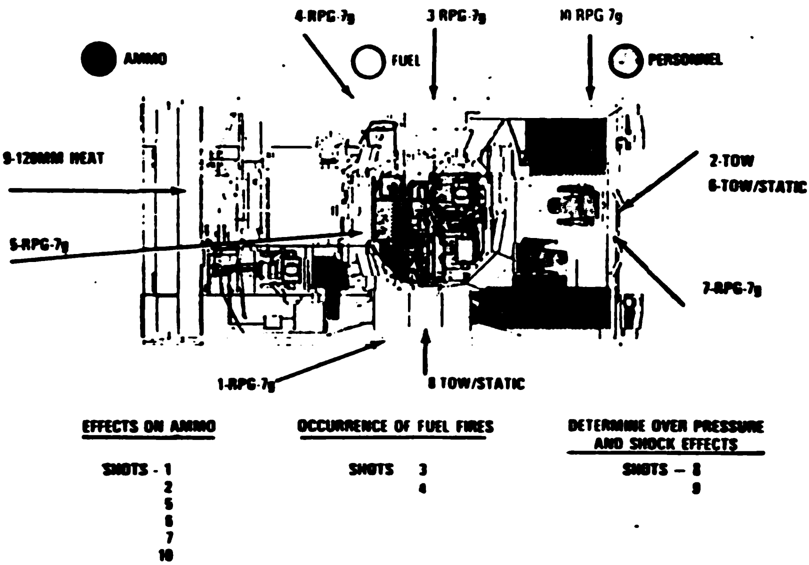
  LED TO THE 1985 VULNERABILITY TESTS
- KNOWN-FROM PREVIOUS AMMO TESTS
  - RPG-7 - INTO
  - TOW - INTO
  - 120MM HEAT - INTO

  (TOW WARHEADS / TOW FLIGHT MOTOR / 25MM HE) → CATASTROPHIC DAMAGE

We got into vulnerability testing at the onset of 1980 as the chart indicates at the top, where the four items at the top were indicated as being major items to be tested, and we successfully passed those particular tests.

Now, it was determined that we ought to go further in vulnerability testing, so we did that. We had some discussion with people at the Department of Defense about the extent of the tests. This is an issue of contention, and, therefore I will lay it out. We conceded that the items at the bottom of the test—clearly overmatching weapons—when they hit TOW warheads or TOW flight motors or 25 millimeter high explosive rounds inside the vehicle, will produce catastrophic damage. So, we said we already know that going in, therefore, the question is, given the number of vehicles we want to consume in these types of tests, and what you really want to get out of it, that we would pursue those things where overmatching weapons produce some uncertainties. Those were the items in the middle where it says adequacies of fire suppression on occurrence of secondary fires, et cetera, effect of small ammunition and the like. So we would tell you that there was some discussion between us and the Department of Defense, and the Department of Defense ultimately accepted the test plan and we proceeded to do that.

## 1985 VULNERABILITY TESTING
## SHOTS FIRED INTO BRADLEY (FULLY LOADED)
## + (58 OTHER SHOTS INTO COMPONENTS)




Now, the next chart shows some of the test plan. First, I would call your attention to the fact there were a total of 68 shots; 58 shots were into components other than the full-up vehicle. There were 10 shots into the full-up vehicle. You will notice they are all in and about the crew compartment and the like. Those are overmatching weapons against which the Bradley was not designed to defeat, and to the best of our ability we tried to replicate the opportunity of overmatching effects on the vehicle. We are trying to look at those identifiable components, and unidentifed components that would make our test models more accurate.

Now, let me set the record straight on vulnerability testing. It is very useful to us. The test design plan was jointly developed with the Department of Defense, approved by the Department of Defense, and was conducted under their observation. The test report was put together with full participation of the Office of the Director of Tests and Evaluation, of the Under Secretary of Defense for Acquisition, Research and Development. No aspect of the tests has been conducted without the oversight of the Department of Defense test community. So it has been open and above board.

Have there been differences between interpretation of the tests? The answer is yes. I think that is a matter that says analysts can disagree——

Mr. STRATTON. Let me interrupt here. I think we are getting into too many things at the same time. Our first concern is what is the

mission of the Bradley Fighting Vehicle. Is it a tank? Is it a covered M-113? What is it supposed to be doing?

General THURMAN. OK, in the defense, the concept of employment for the Bradley Fighting Vehicle takes advantage of the long range TOW missiles that are aboard it with a range of 3,750 meters. The Bradley may be placed in a position that is forward in the defensive position to allow it to engage approaching targets, primarily tanks, at a range out to 3750 meters. As the battle closes to the range of one to two kilometers, the Bradley can engage with its 25 millimeter cannon. Then it may withdraw to subsequent positions with infantry aboard.

Mr. STRATTON. My understanding is in the traditional infantry operations tanks are always followed by infantry.

General THURMAN. If they were in the offense that would be the case.

Mr. STRATTON. And that was what happened in the encounters in the Yom Kippur War where we had the largest number of destroyed tanks that I think anybody has ever seen.

General THURMAN. That is right.

Mr. STRATTON. And were those tanks followed by infantry, did they have Bradley vehicles of some kind to pursue them?

General THURMAN. First, let me say that the combined arms team is the way in which you have to fight the battle of today. Now, in the Yom Kippur War, in the opening days of the war, the Israelis launched an attack with armored forces only, and they were severely damaged in that particular attack. Several days later, in the later stages of that particular war, they marshaled their infantry forces, then with combined infantry and armored forces they were successful in crossing the canal and resuming the offense, including the use of airborne troops across the Suez Canal.

So in the combination of activity between tank and the infantryman, supported by a vehicle that gives him the capability to reach out and destroy the opposing force tanks. This is the synergy between tanks and infantry on the modern battlefield. Whether you are on the offense or whether you are on the defense, whether you are facing light resistance, medium resistance or heavy resistance on the battlefield depends upon the tactical employment, and the terrain that you may be on.

In general, if you are on the offense, you will find your tanks not your infantry leading. I can ask General Burba if he would like to illuminate that. He is the husbander of tactical doctrine in the Infantry School.

Mr. STRATTON. Well, I haven't been to the Infantry School, but I recall when we went over to Israel and to Egypt after the Yom Kippur War, the Soviets had a vehicle which was designed to provide infantry travel. I have forgotten the designation. You probably——

General THURMAN. The BMP.

Mr. STRATTON. Yes, BMP. That vehicle was covered over, it wasn't like the M-113.

General THURMAN. Right.

Mr. STRATTON. It also had some gun ports, as I recall, that could also be utilized while it was moving forward.

General THURMAN. That is right, sir.

Mr. STRATTON. In contrast, the M-113, I haven't seen that in battle, but it would seem to me that that is a somewhat more hazardous vehicle, is it not, than the BMP, because it can get attacked from not only the side but also from above?

General THURMAN. The M-113 has substantially less armor capabilities. It is designed for 7.62 millimeter. The Bradley is designed for 14.5 millimeter. The Bradley is designed for overhead artillery protection. The Bradley is designed for mine protection, all three constituents which are not in the M-113 as we now know it. Further, the M-113 has no weapon that can reach out and assist the infantryman if he is fighting on foot to the range or to the destructive capacity of the Bradley.

Mr. STRATTON. And that is something that the Soviet vehicle has to a limited degree?

General THURMAN. The Soviets do have an ATGM system located aboard their BMP and they do have a machine gun located aboard that as well as a 73 millimeter cannon.

Mr. STRATTON. I remember you had one of those where the Bradley is located in Fort Hood, TX.

General THURMAN. Yes, sir.

Mr. STRATTON. I went down there several years ago with Mr. Leath and we were invited to drive the M-1 and we were also invited to take a look at the Bradley. I think that is the first time that you saw it. As I recall, it wasn't a tank, it looked a little flimsier than a tank, and it also had, as I recall, something like five or six or seven personnel in the vehicle, and I remember commenting to the troops, I said this: This is a pretty tightly packed vehicle, isn't it? What are your feelings about it, what do you think about it, and they said, well, it is a heck of a lot better than walking behind a tank, I can tell you that.

So what you are attempting to do with the Bradley, as I understand it, is to provide something that is not a tank but is going to provide some protection for the infantry that basically are required to follow on behind the tank and mop up?

General THURMAN. That is right, sir.

Mr. STRATTON. And so that the argument, as I have seen it, by some of the people who are most vocal, is that they are complaining that it is not a tank and therefore, it can't perform like a tank.

I had a gentleman from Israel, a manufacturer from Israel, in my office the other day, and he showed me how they would be able to provide heavy armor for the Bradley vehicle and it looked as though they had 3 or 4 inch armor on virtually every portion of that Bradley vehicle. That wouldn't be too effective, would it, General?

General THURMAN. In the next series of vulnerability tests, as I will describe, we are looking at the application of some armor enhancing capabilities, some of which is called reactive armor. So it will be limited application about that. We will run tests on that. That will be part of the report back out to the committee in June. So if we can manage to improve its invulnerability, we will do that.

Mr. STRATTON. OK, I have taken enough of your time, but go ahead. I think this clarifies the basic mission of the Bradley vehicle.

General THURMAN. Let me go ahead with the vaporifics here. Those are the shot schedules that we put up, the 10 that are reported against live full-up vehicles, and I indicated there were a total of 68 shots.

## WHAT WE LEARNED

- JET IMPACT ON AMMUNITION MAJOR HAZARD TO VEHICLE AND CREW
- AUTOMATIC FIRE SUPPRESSION SYSTEM EFFECTIVE IN EXTINGUISHING FUEL FIRES
- LITTLE EFFECT ON VEHICLE OR CREW DUE TO OVERPRESSURE AND TEMPERATURE (VAPORIFIC EFFECT)
- PREVENTION OF PENETRATION AND SPALL WILL REDUCE VEHICLE DAMAGE AND CASUALTIES
- SPALL HAS MINIMAL EFFECT ON AMMUNITION DUE TO AMMUNITION PACKAGING
- SECONDARY FIRES UNLIKELY

SURVIVABILITY CAN BE IMPROVED

What did we learn about all of that during testing? We learned that it is clear that the jet impacts on the ammo are hazardous to the vehicle and crew. We learned that the fire suppression system is doing very well—it actually does too well, it fires when it shouldn't, but it fires in the right direction, and errs on the safety side. We are trying to reduce it so it fires only when it is required and not otherwise.

There is little effect on the vehicle or crew due to vaporifics. Prevention of penetration and of spall reduces vehicle damage and casualties. That was the point you were talking about, third from the bottom. If you are able to put on some additional applications, and put the spell liners inside, that will obviously reduce vehicle damage and casualties. The secondary fires are unlikely. We learn then that you can improve the vehicle and that is where we are going.

# WHERE WE ARE GOING

- IMMEDIATE IMPROVEMENTS
  - FUEL SYSTEM REVISED
  - FIRE SUPPRESSION SYSTEM REVISED
  - ARMOR COVERS FOR PERISCOPES

***IMPROVEMENTS CUT IN MAY 86 PRODUCTION***

There were some immediate improvements we have put on the current production. Letting the upper fuel tank drain first, and improve the fire suppression system so that when we move a sensor, it will not go off erroneously even on the safe side. We will protect the periscopes with armor covers and they will be in the May production of this year. Then we will begin to run the phase 2 testing and evaluation for the report to Congress in June.

## PHASE II TESTING EVALUATES

- IMPROVED ARMOR (INCLUDING OVER MATCHING ROUNDS)
- SPALL LINERS
- IMPROVED FUEL SYSTEM
- IMPROVED FIRE SUPPRESSION SYSTEM
- ARMORED PERISCOPE COVERS
  - 25MM AMMUNITION COMPARTMENTS
  - PERSONNEL HAZARDS (TOXIC GASES, FLASH BLINDNESS, ETC)
  - REPEAT PHASE I SHOTS – WHERE CHANGES COULD ALTER DATA
    - PHASE I: 68 SHOTS INCL 10 FULL-UP – 3 VEH
    - PHASE II: UP TO 52 SHOTS INCL 34 FULL-UP – 2 VEH

    (ALL FULL-UP SHOTS – DYNAMIC FIRING)

***PHASE II OUTLINE TEST PLAN SUBMITTED TO OSD ON 18 FEB 86***

These are the main points associated with the phase 2 testing. Improved armor, spall liners, improved fuel system, fire suppression. We will repeat the armored shots down at the bottom and we will repeat the phase 1 shots where there are any changes that could alter data.

I remind you that in phase 1 we had 68 shots, including 10 full-ups that used up three Bradley vehicles. In this case, we will be shooting 52 shots, including 34 fullup, and two vehicles.

Today, I signed out a document to the Under Secretary of Defense for Research and Engineering which transmits our draft test plan to him. Subject to his approval, we will commence on those tests and be prepared to report out to you in June.

# ARMY ANALYSES — NO ALTERNATIVES RULED OUT

**LARKIN TASK FORCE – 1976**

MICV WITH ONE & TWO MAN TURRET, – WITH + W/O TOW

BMP

M113

M113 STRETCH WITH TURRET

**1977 COEA**

M113A1

MICV – W/20MM

AIFV (DUTCH)

IFV/CFV – TWO MAN TURRET WITH AND W/O TOW

M113A1 AND ITV

**CRIZER TASK FORCE – 1978**

M113A1

IFV/CFV

SPECIAL ARMOR IFV (55T, 61T, 65T)

SPECIAL ARMOR CFV (55T, 61T, 65T)

M113A1 WITH ITV

BMP

**MAHAFFEY SPECIAL STUDY GROUP – 1978**

IFV/CFV – ONE AND TWO MAN TURRET, WITH AND W/O TOW

SPECIAL ARMOR IFV/CFV

ARMORED CAV COMBAT VEHICLE

STRETCH M113A1 W/TURRET

ARMORED CAV COMBAT VEHICLE

**IFV/CFV COEA UPDATE – 1979**

IFV/CFV

M113A2

AIFV (DUTCH)

ARMORED CAV COMBAT VEHICLE

Now, you asked a question that is about the results that you described and we are happy to go further in detail if you would like. On the analysis of alternatives, this chart represents the history over time as to alternatives looked at for the Bradley fighting vehicle. It started out in 1976, when we looked at the mechanized infantry vehicles with one- and two-man turrets, with and without TOW missile systems. We looked at the Soviet BMP, looked at the M–113 in those days, and we looked at a M–113 stretched version with turret, and in the cost and operational effectiveness analysis in 1977, we did the same, including the Dutch vehicle.

In 1978 we did the same, and here is where we even looked at a vehicle that was as high as a 55-ton vehicle—to perform duty on the battlefield. It just wasn't technically feasible to do it at that time. And then we had another study in 1978 that looked at a variety of vehicles. Finally, the update that went into production—bottom right—which looked again at the M–113 that was available, as well as the Dutch vehicle, and the other, and in all cases we continued to find that the Bradley fighting vehicle was a winner in that review.

## ALTERNATIVES

**TODAY**

1. CURRENT BFV
   - M2A1/M3A1
   - BLOCK 1
   - TOW II

2. M113A3
   - CAL 50
   - M175 DRAGON MOUNT

**TOMORROW**

3. ENHANCED BFV
   - BLOCK II: IMPROVED AMMO STOWAGE, SPALL LINER, ARMOR

4. 4 M113A3's + 2 ITV's/PLATOON
   - M113: ENHANCED SURVIVABILITY PACKAGE
     - 25MM GUN/1 MAN TURRET
   - ITV: SAME VEHICLE PERFORMANCE AS M113A3
   - FORCE STRUCTURE PLUS UP
     - 24 ITVs TO MECH BATTALION

5. M113A3: 1-MAN TURRET

6. M113A3: CAL 50 + M175 DRAGON MOUNT

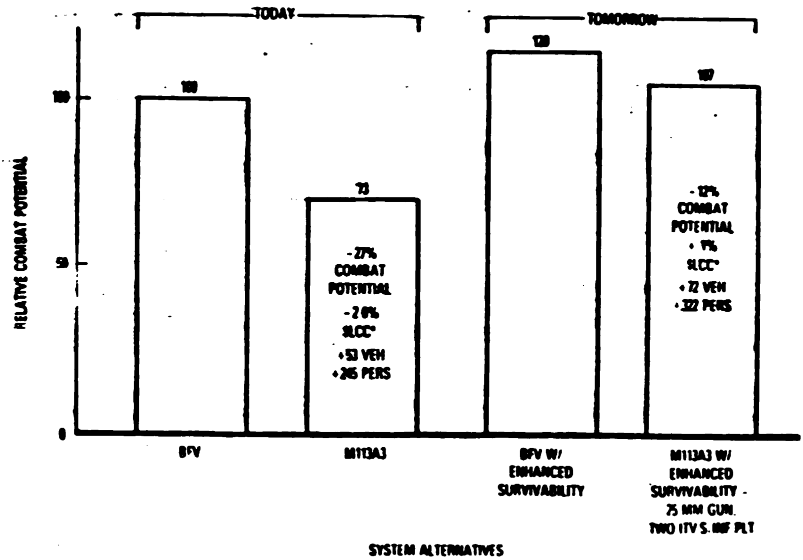
7. STRETCH M113A3: BRADLEY TURRET

We have recently looked at other alternatives. They were a current Bradley fighting vehicle versus a M-113 with caliber 50 machinegun and the dragon that I showed you that was on the first chart where we described the range down to the Memorial Bridge versus the range to L'Enfant Plaza. Then we are looking at the enhanced Bradley, and when we get done with the tests in June to see what can be done to improve its survivability and reduce its vulnerability.

We looked at the M-113 and ITV mix. This added more vehicles to the unit to compensate for taking the TOW off of the M-113, and then three other alternatives which get down into the final one, No. 7. A M-113 which would have a Bradley turret on it with all the research and development that would have to go along to bring something like that on line.

## HEAVY DIVISION COMBAT POTENTIAL

AFP/MICAF MODEL
BALANCED HEAVY DIVISION
CLEAR DAY DEFENSE AND ATTACK POSTURE




*LCC - LIFE CYCLE COST

Now, I have the results of the first four that would simply say to you that today, with the Bradley fighting vehicle in the left column, if you regressed to an updated M–113, it would cost you 27 percent of the combat potential of a division. That is minus 27 percent of the combat potential of a division, and, while it would reduce life cycle costs by about 2.6 percent, it would also cost you another 245 personnel per division. So, regressing to a M–113 would be a step in the wrong direction, given the notion that we are outnumbered by the hostiles.

If you look on the right, at the Bradley fighting vehicle, in the third column from the left, with enhanced survivability, the packages that we estimate will work with the tests that we are running in March/April and then report out in June, against a M–113 with even a 25-millimeter Bushmaster gun on it, and supply two more TOW Bradley fighting vehicles with it, again, you would get a 12 percent combat differential as you look downrange to tomorrow. So the alternatives at the moment seem to say that going with the Bradley you have higher firepower contribution, lower personnel costs, simplified command and control, better mobility, and better overall support of the combined arms team. We will report out on all seven of those alternatives to your committee, sir, in detail, as we finish the runs and they will be turned over to your staff.

# FY 87 BRADLEY PROGRAM
## $ (M)

**RDTE**

| | | |
|---|---|---|
| SURVIVABILITY IMPROVEMENTS | 19.9 | IMPROVED ARMOR<br>SPALL LINERS<br>AMMO COMPARTMENTS |
| 25MM (AMMO) | 12.8 | ARMOR PIERCING ROUND |

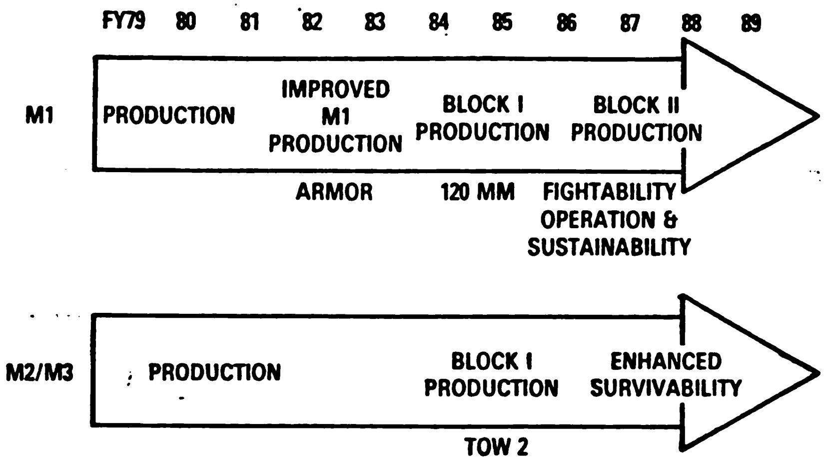
**PROCUREMENT**

| | | |
|---|---|---|
| BFV | 1142.4 | 870 VEHICLES (14+ BNS) |
| BFV (MOD) | 35.1 | 86 RETROFIT KITS (A1)<br>OPTICAL IMPROVEMENTS<br>BLACK OUT LIGHTING |

Now, for the next chart, closing to the end, and I will be ready for questions.

What is the 1987 Bradley program that is before the Congress? Two items on survivability improvements, including the up-gunning of the armor piercing round, which will be able to improve its performance against the BMP II—and we are constantly in the business of upgrading our ammunition as we go along—and the 870 Bradley fighting vehicles that you describe, which will essentially equip 14 battalions of troops with that 870. Then we do some retrofit of previous systems that will be fielded.

# THE IMPROVEMENT PROCESS




Let me talk a moment about the next chart on the improvement process that is not unknown to this committee. You have taken steps to endorse the M–1, which is at the top and you will note we went into production, and we have improved the M–1 production in armor capabilities. Then we started the block I, which was the 120-millimeter gun, and we are continuing to look at other block improvements which will give us increased fighting capability in operations and sustainability. At the same time, with the Bradley fighting vehicle, at the bottom, we have already finished the first step in improving its survivability by improving its TOW missile system on board, which is the TOW II, and that will be cut into production in 1986 and we will continue to do that.

I would just say that the whole point of this says that with change in threat requirements and effects our notion of how to product improve things, and you have been a supporter of that process.

Mr. Stratton. It is going to cost you some money to do that, isn't it? You talked about taking a look at armor that you can hang on. What would be the cost of that?

General Thurman. Well, we have estimated the cost of all of the improvements for 1987—and General Wagner can correct me if I am wrong—it is about $80,000, and is built into that sum of—if you back up one more chart—built into that value of $1,142.4M is the sum of $81,000 each for further enhancements in survivability.

Mr. Stratton. I don't know whether Mr. Gramm or Mr. Rudman are going to approve of that.

What about weight, General?

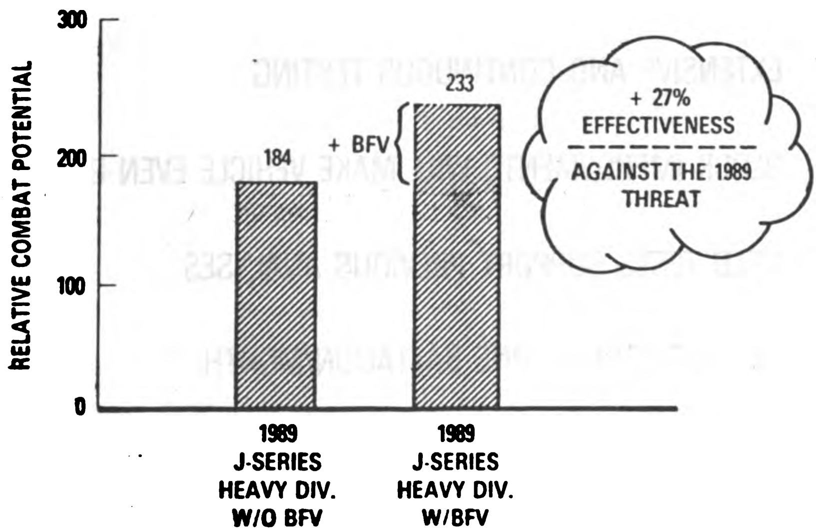
General Thurman. The weight is approximately 7,000 pounds and the transmission and engine associated with the vehicle are able to handle that without loss of agility and mobility on the bat-

tlefield. It may reduce its top speed from 42 to 40 miles per hour, but it will not reduce its dash speed from zero to 30 miles per hour. That is to be tested when we run through our tests.

Gramm-Rudman, sir, is something we face in each one of these programs.

So let me summarize with my last two charts. Then I will turn off the machine there.

## EFFECT OF FIELDING CURRENT BRADLEY IN A HEAVY U.S. DIVISION




*... AND WITH SURVIVABILITY ENHANCEMENTS ... EVEN MORE!*

What is the effect of fielding the current Bradley in a heavy division? The answer is it is a 27-percent improvement in effectiveness against the 1989 threat. With the survivability enhancements that we will test later this year, and determine which ones should be applied, it will be even more. That is sort of a derivative of saying that the funds that you approve, sir, in 1987, put hardware in the field in 1988.

# BRADLEY FIGHTING VEHICLE

- CONSISTENT REQUIREMENTS AND DOCTRINE
- VITAL MEMBER OF COMBINED ARMS TEAM
- EXTENSIVE AND CONTINUOUS TESTING
- BLOCK IMPROVMENTS WILL MAKE VEHICLE EVEN BETTER
- FIELD TESTS SUPPORT PREVIOUS ANALYSES
- IN PRODUCTION– ONE BATTALION/MONTH

Now, the last chart. What I have tried to bring to you today, sir, as a platform for dialog is that the Bradley meets its requirements, it is ratified by a lot of study and analysis over time. It is an integral part of the consistent combat arms team which has as its requirement fighting the hostiles who outnumber us, by maneuver warfare, and the Bradley Abrams team does that. Tanks are naked without the Bradley, which unstresses them and permits them to use their full capability of maneuver in order to destroy the Soviet opposition. Without the Bradley, we are faced with attrition warfare, which means you service the targets but you are not in the maneuver business.

We have had extensive and continuous testing. We support the vulnerability testing that we are currently embarked on. We have improvements to make the vehicle even better, and the vehicle is currently in production through the courtesy of this committee and others, who have seen us now ramp the production up to one battalion per month. We would commend to you that you continue that support.

We are open for questions.

## Prepared Statement of General Thurman

### THE BRADLEY FIGHTING VEHICLE

INTRODUCTION

Mr. Chairman, we are honored to be here and appreciate this opportunity to testify concerning the Bradley's battlefield effectiveness. In order for our Army's mechanized infantrymen to perform their required tasks, they need a vehicle with the following performance capabilities:

**THE BRADLEY REQUIREMENT**

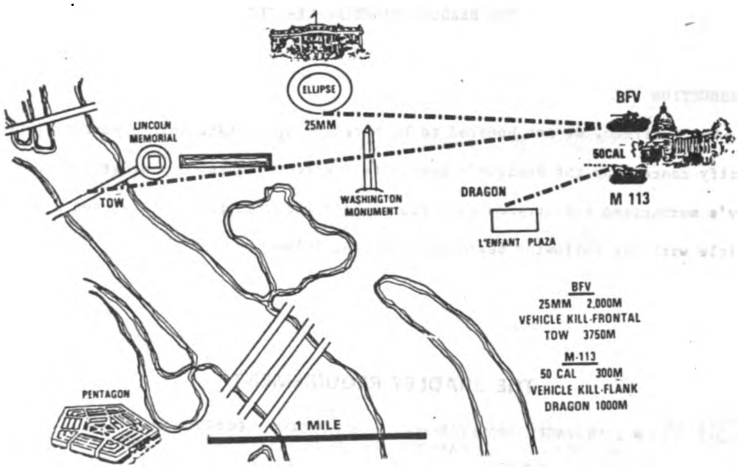
- LONG RANGE WEAPONS CAPABILITY, NIGHT AND DAY, UNDER ARMOR, AGAINST TANKS LIGHTLY ARMORED VEHICLES (PARTICULARLY THE BMP), AND DISMOUNTED TROOPS
- MOBILITY COMPATIBLE WITH TANKS
- STABILIZED CANNON/MACHINE GUN (SHOOT ON THE MOVE CAPABILITY)
- PROTECTION AGAINST ARTILLERY, AUTOMATIC WEAPONS AND SMALL ARMS
- CAPACITY TO CARRY A SQUAD AND ITS EQUIPMENT FOR DISMOUNTED OPERATIONS
- SWIM CAPABILITY

NOTE: ORIGINAL REQUIREMENT DOCUMENT 1968
RATIFIED BY CRIZER REPORT, 1978, PAGE I-4
FUNDED FOR PRODUCTION 1979

*REQUIREMENTS MET – PRODUCTION – 2085 IN SERVICE*

Currently, the United States is approximately one-third through the process of providing its mechanized infantrymen with precisely that capability: the Bradley Fighting Vehicle. The Bradley is the replacement for the M113. This chart shows the dramatic increase in armored vehicle killing capability which the Bradley provides.

## MAXIMUM EFFECTIVE RANGES
### M-113 — BFV




**PREVIOUS TESTIMONY**

Reviewing previous testimony and hearings on the Infantry Fighting Vehicle and its predecessor, the Mechanized Infantry Combat Vehicle (MICV), one senses the keen interest displayed by members of the Congress at all stages of the Bradley's development. The Army appreciates the Congressional interest and support received over the past twenty years, not only for the Bradley, but in modernizing the entire force. We believe, given that we must fight outnumbered, that the Bradley is critical to our conventional warfighting capability. All our studies show: With it we can win. Without it we lose! The Bradley complements and enhances the capabilities of the other members of our combined arms team - particularly the M1 Abrams tank - in the execution of today's maneuver warfare doctrine.

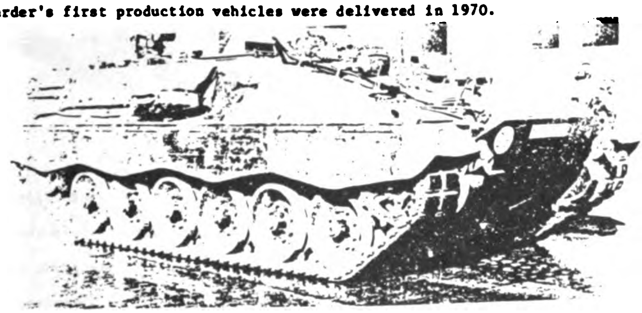
**TODAY'S REVIEW**

Today we shall review why we chose the Bradley to be our fighting vehicle system, and how we employ it on the battlefield. We shall also address what we have learned from the recent vulnerability testing and where we are going with that program. We shall discuss other vehicles that might be considered as alternatives to the Bradley, and provide you some recent analyses that confirm our decision to field the Bradley. Finally, we shall speak of the benefits of maintaining the Bradley on an uninterrupted production schedule while cutting in those necessary improvements which our analyses and testing show to be beneficial.

HISTORICAL AND OPERATIONAL PERSPECTIVE

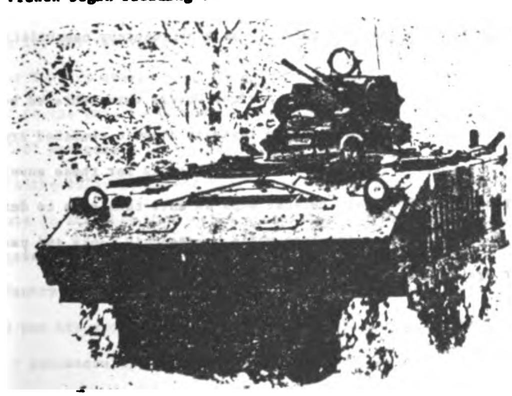
Our requirement for the Bradley predates the Vietnam War. The Soviet leadership reached a similar conclusion in the early 1960's and began introducing the BMP into their infantry forces in November 1967. This increased firepower in Soviet maneuver units severely stressed the ability of our outnumbered force of tank main guns to dominate the close-range defensive battle. All our studies pointed to our need to proliferate a long-range ATGM capability on the battlefield. Our force structure constraints pointed to a clear preference for proliferating ATGM's (the TOW) on existing armored vehicles. The need for rapid, shoot-on-the-move, accurate suppressive fires and a capability to defeat the BMP led to the selection of the 25mm cannon.

The United States Army was not alone in recognizing the benefits which accrue from proliferating fighting vehicles on the battlefield. The German Marder's first production vehicles were delivered in 1970.



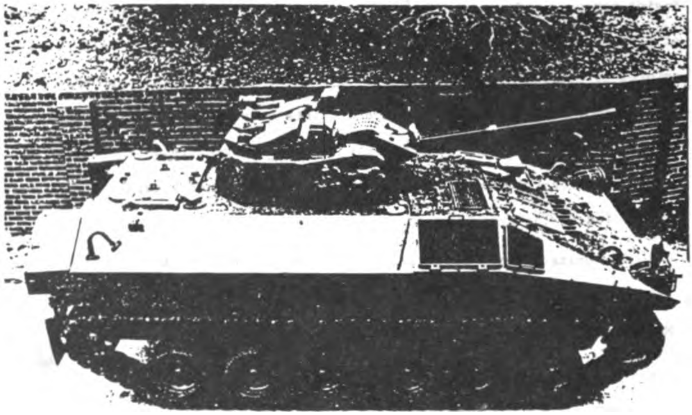
THE GERMAN MARDER

The French began fielding their AMX-10P in 1973.



AMX-10P MICV (GIAT)

The Dutch Armored Infantry Fighting Vehicle (AIFV), a US M113 variant, was ordered from FMC in 1975 for delivery beginning in 1977. In the early 1970s the UK awarded modification contracts to upgrade their FV432 APCs as fighting vehicles. The latest British fighting vehicle is the MCV-80, which the UK began fielding in 1985.

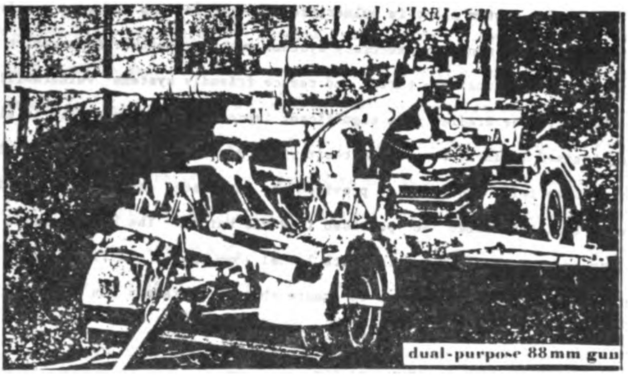


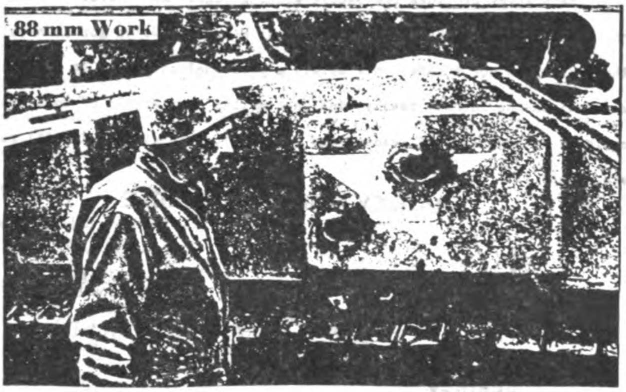
The United States Army lags many of our allies in getting this needed capability on the American sector of the battlefield. The Bradley, approximately one-third fielded, gives that needed winning potential for the battle at the front and the ability for mechanized infantry to maneuver with the M1/M1A1 Abrams-equipped tank force committed in offensive action.

THE BENEFIT OF COMBINED ARMS

I should like to provide two historical vignettes which make the point that tanks need fighting vehicles and infantry as complementary capabilities to win.

Erwin Rommel's successes in the African Desert were achieved because he was able to mass his badly outnumbered tanks in classic combined arms sweeps into his enemy's rear. To free his few tanks for these envelopments, he cleverly used his 88-mm air defense guns as anti-tank guns to destroy, or hold enemy (British) forces in place while he used his tanks and panzer grenadiers to maneuver against the enemy's flanks or rear.




The German "88" was able to defeat allied tanks because it could engage those tanks beyond the effective range of the tank gun.

The German "88" was a towed system with no armored protection. It could be dug in, but its value and, indeed, its survivability lay in its ability, much like our TOW, to engage the tank beyond the range of the tank gun's effective fire. Later in the war, to improve its survivability, the Germans put armor around the "88" and called it the Tiger tank.

Early in the 1973 Yom Kippur War, an Israeli armored division suffered heavy losses becauae it attacked with tanks unsupported by infantry, engineers, or artillery against a strong anti-tank capability - in this case provided by Eygptian infantry armed with wire-guided antitank missiles. Days later, the Israeli Army put its combined arms team - infantry, armor, artillery, close air support - successfully to work. The lesson for the combined arms contribution is a verity even on today's high-tech battlefield.

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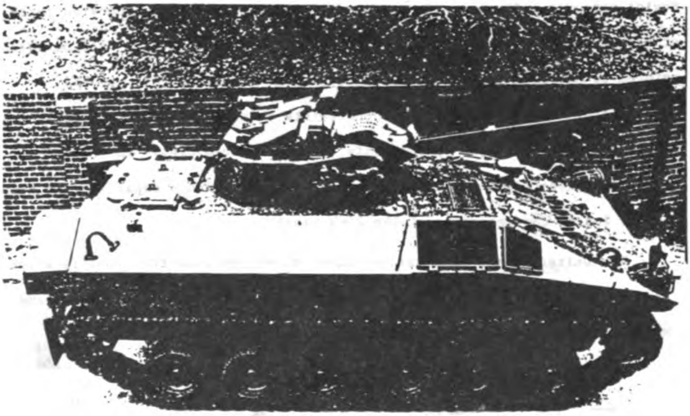

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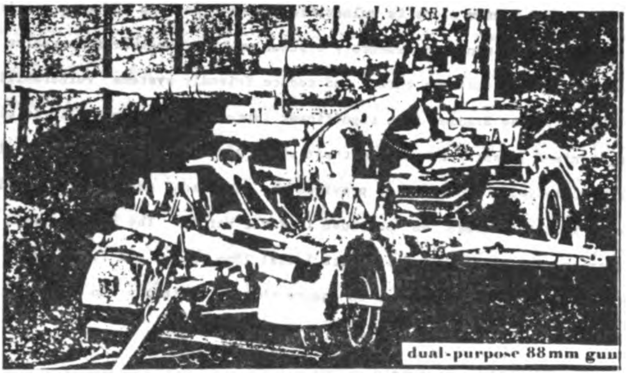


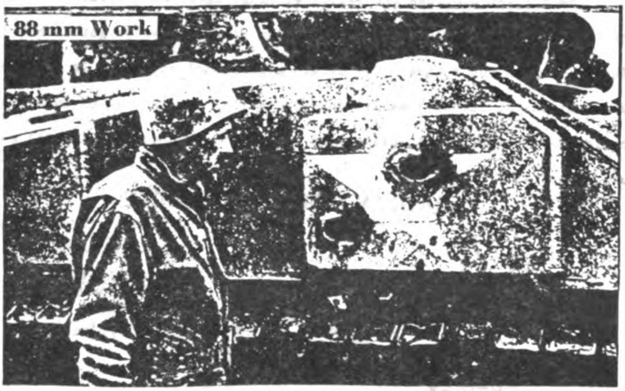


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Any combat system alone is vulnerable; winning battles and wars requires the interaction of many complementary systems working together to maximize their potential against the threat and reduce friendly systems' vulnerabilities. Used properly, the Bradley is a significant improvement over our M113 in allowing the mechanized infantry to perform their vital mission on the fast-paced, lethal, modern battlefield. The Bradley provides the long-range anti-tank capability of today that the German "88" provided in World War II. The Bradley gives mobility and increased protection. Its lethal 25mm cannon and 7.62 coaxial machine gun can fire-on-the-move to ensure that our infantry can accompany the tank force and protect that force in close-in battles.

BRADLEY EMPLOYMENT AND SURVIVABILITY

The Bradley provides the battle-winning edge. As General Wickham said the other day during his Posture Statement hearing, "We've got to have it". The Bradley is not a tank - nor merely a personnel carrier. It has the keys to survival on the lethal, deadly, and fast-moving battlefield of today when employed in the hands of leaders and well trained soldiers. It will survive if used properly.

## BRADLEY FIGHTING VEHICLE


**BRADLEY:**

- IS VULNERABLE AS ARE ALL SEA, AIR AND LANDSHIPS
- HAS THE KEYS TO SURVIVAL ON THE LETHAL BATTLEFIELD, NAMELY:

| | |
|---|---|
| ATGM TANK KILLING CAPABILITY | STABILIZED GUNS |
| OUTRANGE TANK CANNONS | AGILITY AND SPEED |
| FIRES FROM DEFILADE | FIRING PORT WEAPONS |
| THERMAL SIGHTS - NIGHT/SMOKE | SMOKE GENERATOR AND GRENADE LAUNCHERS |
| IMPROVED ARMOR VS M113 | |

- WILL SURVIVE WHEN USED BY TACTICALLY COMPETENT LEADERS AND WELL TRAINED SOLDIERS

FIGHTING DOCTRINE

There has not been any significant change to our Bradley tactical doctrine since it was originally published in 1978. Our tactical doctrine is designed to maximize the effectiveness of all our battlefield systems and minimize their vulnerability. If a Bradley stands still (exposed) in the open, it is as vulnerable as an F16 on a runway or as were our battleships when they were caught tied to piers and moorings on December 7th, 1941. Our doctrine calls

for Bradleys to be in defilade or covered behind folds in the terrain, and to use their speed to dash from covered position to covered position. In open terrain against light resistance (squad or platoon size with few anti-tank weapons, no combined arms assets, and not dug in) the Bradley elements of the company team will normally follow tanks when the force is moving toward an objective. In medium threat situations (enemy platoon or company size in hastily prepared positions) Bradleys will normally overwatch, suppressing and destroying targets at the extended ranges of their cannon and missiles to allow tanks and/or dismounted infantry to maneuver. Against heavy resistance, (platoon or company size in well prepared positions or strong points) even the tanks should join the Bradleys in overwatch. Dismounted infantry supported by the fires of the Bradleys, Abrams, massive artillery, and US Air Force close air support may then be required to penetrate the enemy's defensive positions. In close terrain, such as forests or urban areas, the threat of enemy antitank teams may force our commanders to lead with their infantry to clear the way for their tank force. In this mission, infantry will normally lead <u>dismounted</u>. In a battalion task force battle, any of these situations may apply to a specific piece of ground, and commanders at every level will be making decisions on the best way to maximize the capabilities of our combined arms team.

SQUAD SIZE

The Bradley carries a 9-man infantry squad (but has room for a tenth soldier). The size of the mechanized infantry squad size was specifically addressed in a major Army study (the "Mahaffey Study") in 1978. That study showed a nine-man organization was capable of accomplishing the infantry squad mission; a seven man organization was unsatisfactory; the most effective squad was the eleven men version. However, in looking at the infantry and armor force, there were corroborating studies supporting the benefits of higher leader-to-led ratios. These studies led the Army to restructure its tank platoons into four tanks per platoon instead of the previous five. In the mechanized platoons, the same logic argued for the fully capable nine man squad. The subsequent J-series mechanized battalion organization provided for 36 squads of nine men per squad, whereas the previous M113 organization contained 27 squads of eleven men. The Bradley vehicle is an integral part of the Bradley squad. The vehicle uses the TOW, 25mm cannon and coaxially mounted 7.62mm machine gun to provide an awesome base of fire for the dismounted infantry maneuver element.

**BRADLEY ALSO A SCOUT VEHICLE**

Our Bradley is not only an infantry vehicle; all our maneuver battalions (tank and mechanized infantry) as well as our cavalry squadrons use M3 Bradley's as scout vehicles. In addition to the Bradley commander, driver, and gunner, M3 Bradleys contain two scout observers, carried in the rear. Scouts and cavalry have their time-honored roles.

**ROLES OF SCOUTS AND CAVALRY**

- GAIN INFORMATION
- PROVIDE EARLY WARNING/REACTION TIME
- DEVELOP SITUATION
- GAIN AND MAINTAIN CONTACT WITH ENEMY
- DECEIVE, DELAY, DISORGANIZE ENEMY
- DEFEAT ENEMY RECON ELEMENTS
- FORCE ENEMY TO REVEAL INTENTIONS BY PREMATURE DEPLOYMENT
- AFFORD COMMAND FREEDOM OF MANEUVER
- PROVIDE SECURITY FOR THE FORCE

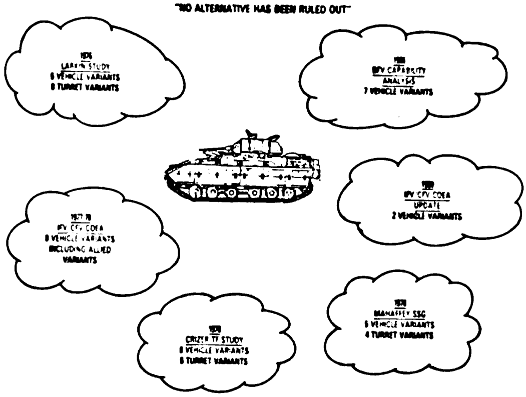
The M3 Bradley with its extra ammunition load and scout observers is well-suited to these roles. The fact that a scout Bradley looks from a distance like its infantry-bearing cousin is a benefit. The enemy will not be able to tell if he is engaging reconnaissance forces or our main positions.

**HISTORY OF THE BRADLEY**

Mr. Chairman, the history of the Bradley is, unfortunately, a long one--too long--as you well know.

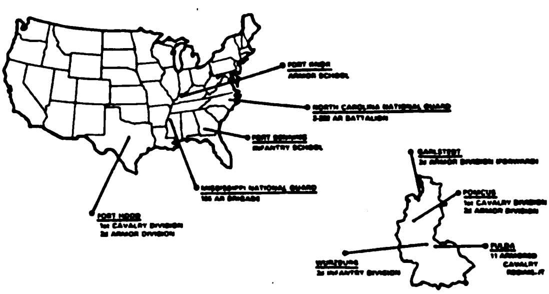
**BRADLEY FIGHTING VEHICLE STUDIES**

"NO ALTERNATIVE HAS BEEN RULED OUT"



I shall not spend time reviewing that history in detail for the committee, but I shall append a synopsis of it to this statement. Suffice it to say that the requirement stems from the late 1950's. Studies to support the requirements definition process began in earnest in the early and mid-sixties, and there have been six major studies since 1976 looking at the requirement. These studies have always been accompanied by a healthy debate. As a result of continued Congressional interest and a 1977 GAO report, the Army directed the Crizer Study and OSD directed the Mahaffey Study. Both studies re-confirmed the requirements for the Bradley. In July 1977, a watershed year in the development of the Bradley, Congress directed that the first vehicle be produced by May 1981.

**WHERE BRADLEYS ARE NOW**




Today we have fielded 389 Bradley's into the 3d Infantry Division, 194 into the 2d Armored Division(-), 174 into the 1st Cavalry Division, and 63 vehicles into the 1st Bn, 155th Inf (Mississippi ARNG). The 11th Armored Cavalry Regiment has an additional 122, the 2d battalion, 252d Armor (North Carolina ARNG) has five. Four battalion sets have been fielded in POMCUS and the 2d Armored Division (FWD), which will get 76 Bradleys, started New Equipment Training in Germany last month. In the near future six each will go to the 1st and 2d battalion, 198th Armor (Mississippi ARNG), and 63 into the 3d battalion, 141st Infantry (Mech) (Texas ARNG), in FY86. The remaining Bradleys are in war reserves, the training and testing base, and in transit or awaiting fielding. As of December 31st, 1985, the Army had accepted 2085 Bradleys.

BRADLEY TESTING

The Bradley has been one of the most extensively tested systems in our inventory, with 18 separate tests being conducted in the past eight years.

## BFVS TESTING

| | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 |
|---|---|---|---|---|---|---|---|---|---|
| DT | ✓ | ✓ | | | ✓ | ✓ | ✓ | | |
| PRODUCTION | | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| OT/FOTE | ✓ | ✓ | ✓ | | | ✓ | | | |
| VAPORIFICS | | | | | | | ✓ | | |
| VULNERABILITY | | | ✓ | | | | | ✓ | ✓ |

In all, over 2600 items have been tested, and the test results have been used to improve the weapon as well as to justify our confidence in it.

Moreover, current performance in the hands of the troops exceeds both the initial requirement and the results achieved during development.

## RESULTS

DT: TOTAL MILES 22,000 — MMBF REQ'D 195; ACHIEVED 200; CURRENT 500

TOTAL ROUNDS FIRED — TOW · 80; 25MM · 27,302 } MET ACCURACY CRITERIA

PRODUCTION: TOTAL MILES 86,000 — MMBF REQ'D 205; CURRENT 500

TOTAL ROUNDS FIRED — TOW · 97; 25MM · 102,102 } MET ACCURACY CRITERIA

OT: 78 · GUN SELECTION (25MM-HH VS FORD)
79 · OPERATIONAL EFFECTIVENESS (OT II) INFANTRY PLATOON
80 · CFV TESTING (FDT&E)
83 · BN LEVEL (FDT&E) 2 AD INFANTRY BATTALION _ 6 MONTHS EVALUATION

VULNERABILITY TESTING

Vulnerability testing was begun in 1980 and consisted of vaporifics and ballistics tests. Additional vaporifics tests were conducted in 1984 by Ballistics Research Laboratories and the Office of the Army Surgeon General. These tests were designed to examine the effects of large anti-tank weapons on the crew inside the Bradley. This chart shows the findings of these tests.

## "VAPORIFIC" — OVERPRESSURE TESTING
## 1984 DATA

VAPORIFICS RAPID OXIDATION OF FINELY DIVIDED METALLIC PARTICLES WHICH PRODUCES PRESSURE, HEAT, GASES AND LIGHT

THREAT WEAPONS

- RPG-7
- TOW
- 105 MM HEAT

- OVERPRESSURES WERE NOT OF SUFFICIENT MAGNITUDE TO PRODUCE CASUALTIES
- TEMPERATURES DID NOT ENDURE LONG ENOUGH TO PRODUCE SECOND DEGREE BURNS
- NO SIGNIFICANT CONCENTRATION OF NITROUS OXIDE, NITROGEN DIOXIDE

*FURTHER TESTING ON TOXICITY IN NEXT SERIES*

The recent ballistic vulnerability testing is just another point on the Bradley's testing continuum. We designed the tests to permit us to fill voids in our data base concerning the Bradley's vulnerability. We had already known that certain types of shots into Bradleys would cause catastrophic damage. We did not need to prove that obvious (and expensive) point. Congress has a copy of our test report.

## VULNERABILITY TESTING

- REQUIREMENTS (MET IN [illegible] TESTING)
  - SMALL ARMS — LOW PROBABILITY OF PENETRATION
  - HEAVY MACHINE GUNS — (SAME)
  - ARTILLERY — (SAME)
  - MINES — (SAME)
- UNCERTAINTY - OVERMATCHING WEAPONS
  - ADEQUACY OF FIRE SUPPRESSION SYSTEM
  - OCCURENCE OF SECONDARY FIRES
  - EFFECTS OF OVERPRESSURE AND TEMPERATURE
  - EFFECTS OF PENETRATION AND SPALL ON VEHICLE/CREW
  - EFFECTS OF SPALL ON AMMUNITION
  - VERIFICATION OF MODELS

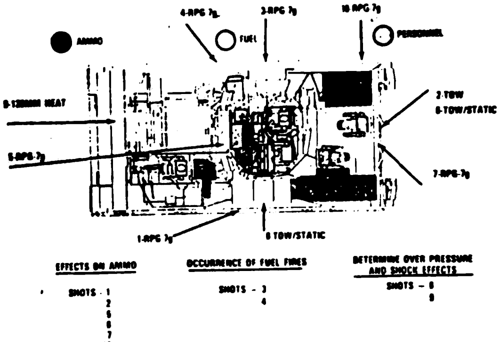
  LED TO THE 1985 VULNERABILITY TESTS
- KNOWN FROM PREVIOUS AMMO TESTS
  - RPG 7 - INTO
  - TOW - INTO
  - 120MM HEAT - INTO

  (TOW WARHEADS, TOW FLIGHT MOTOR, 25MM HE) → CATASTROPHIC DAMAGE

We believe the testing has been very helpful. It was done responsibly and correctly, and the results have been useful. The test design plan was developed jointly with the Office of the Secretary of Defense OSD and approved by OSD. Both OSD and the General Accounting Office (GAO) observed the tests. No aspect of the tests or preparation of the reports was conducted without the oversight of the Department of Defense (DOD) testing community. All the participants agree on the data base provided in our report.

While there were 10 shots against a fully combat-loaded vehicle,

## 1985 VULNERABILITY TESTING
## SHOTS FIRED INTO BRADLEY (FULLY LOADED) + (58 OTHER SHOTS INTO COMPONENTS)



there were a total of 68 shots against vehicle and component configurations. Some shots were executed statically (that is to say near to the point of entry) while some were fired dynamically (from a distance). Some have criticized us for not firing random shots, but random shots are not an efficent way to generate usable data. We were testing specific impact locations to assess areas of uncertainty, so our shots had to hit where we desired them to impact.

There has been some disagreement among analysts on the interpretation of our test data. Specifically on the injuries assessed on shot number 38, on the toxicity of Halon fire extinguishers, and on casualty criteria from overpressure. On shot number 38, we differ with the analysts by two casualties, and we believe this is an area where reasonable men can disagree. We feel this debate is healthy and brings issues to the forefront for resolution. It is the view of the Army Surgeon General that Halon is safe for use in combating fuel fires in the troop compartment. However, we will collect additional data during Phase II to measure toxic gasses. The OSD analyst believes that overpressures resulting in ruptured eardrums should be classified as casualty-producing. The long-standing Army medical position is that such is not the case.

The GAO comments in their draft report are shown below with appropriate Army comment:

| GAO | Army |
|---|---|
| 1. Test shots and results not representative of overall vulnerability; model predictions are required. | 1. The GAO correctly noted that test shots and results were not representative of overall vulnerability, and model predictions were required. Test design was to test for uncertainties. Experimental determination of vulnerability to all combat shots was not practical. Some analytical data was included in the Army Report. Extensive data will be provided later to GAO. A report including all analytical data will be provided upon completion of Phase II Testing in June. |
| 2. Shots into ammunition were excluded. | 2. GAO correctly noted exclusion of certain shots into Ammunition. Test design precluded known catastrophic damage shots as yielding limited information. Nevertheless, six of ten full up shots hit ammunition. |
| 3. Cavalry vehicle only tested; not infantry vehicle. | 3. GAO correctly noted only the Cavalry and not infantry vehicle tested. The Cavalry vehicle, although containing fewer soldiers contained more ammunition, and was considered more vulnerable. |
| 4. Current threats not simulated. | 4. GAO noted current threat weapons/simulants not used. Army believes weapons used were representative of current threat weapons against light vehicles. |

5. Only two planned 120mm tank gun shots fired.

5. GAO correctly noted only two planned 120mm tank HEAT shots were fired. Limited additional information was expected from additional shots by this significantly overmatching weapon. The remaining Bradley test vehicles were required to meet the FY85 committment to OSD for full-up live fire testing.

The testing has been very beneficial and has shown us areas where improvements can be made. The next two charts describe some conclusions and actions we are taking.

WHAT WE LEARNED

0 JET IMPACT ON AMMUNITION MAJOR HAZARD TO VEHICLE AND CREW

0 AUTOMATIC FIRE SUPPRESSION SYSTEM EFFECTIVE IN EXTINGUISHING FIRES

0 LITTLE EFFECT ON VEHICLE OR CREW DUE TO OVERPRESSURE AND TEMPERATURE ( VAPORIFIC EFFECT )

0 PREVENTION OF PENETRATION AND SPALL WILL REDUCE VEHICLE DAMAGE AND CASUALITIES

0 SPALL HAS MINIMAL EFFECT ON AMMUNITION DUE TO AMMUNITION PACKAGING

0 SECONDARY FIRES UNLIKELY

SURVIVABILITY CAN BE IMPROVED

**WHERE WE ARE GOING**

- **IMMEDIATE IMPROVEMENTS**
  - **FUEL SYSTEM REVISED**
  - **FIRE SUPPRESSION SYSTEM REVISED**
  - **ARMOR COVERS FOR PERISCOPES**

*IMPROVEMENTS CUT IN MAY 86 PRODUCTION*

PHASE II TESTING

To continue our efforts to improve the survivability of our soldiers, the Army will begin Phase II testing in March of 1986. Phase II will evaluate the enhancements listed below.

## PHASE II TESTING
## EVALUATES

- IMPROVED ARMOR (INCLUDING OVER MATCHING ROUNDS)
- SPALL LINERS
- IMPROVED FUEL SYSTEM
- IMPROVED FIRE SUPPRESSION SYSTEM
- ARMORED PERISCOPE COVERS
  - 25MM AMMUNITION COMPARTMENTS
  - PERSONNEL HAZARDS (TOXIC GASES, FLASH BLINDNESS, ETC)
  - REPEAT PHASE I SHOTS – WHERE CHANGES COULD ALTER DATA
    - PHASE I: [illegible] SHOTS INCL 10 FULL UP – 3 VEH
    - PHASE II: UP TO 52 SHOTS INCL 34 FULL UP – 2 VEH

    (ALL FULL-UP SHOTS – DYNAMIC FIRING)

**_PHASE II OUTLINE TEST PLAN SUBMITTED TO OSD ON 18 FEB 86_**

The office of the Army Surgeon General will conduct an assessment of the potential hazard to personnel from large caliber overmatches fired into the fuel cell.

A copy of the Phase II Outline Test Plan has been submitted to OSD for review and approval. Once again the Army has invited OSD to participate in Phase II testing.

ALTERNATIVES:

The above shows the azimuth we are taking to lessen our current vehicle's vulnerability. But we are aware that this committee is taking a broader look at the question of whether the Bradley is still the best solution for our infantry fighting vehicle requirement?

The Army has at all points in the development of the Bradley analyzed alternative vehicles, as shown in the studies below:

## ARMY ANALYSES – NO ALTERNATIVES RULED OUT

**LARKIN TASK FORCE – 1976**

MICV WITH ONE & TWO MAN TURRET – WITH + W/O TOW
BMP
M113
M113 STRETCH WITH TURRET

**1977 COEA**

M113A1
MICV – W/20MM
AIFV (DUTCH)
IFV/CFV – TWO MAN TURRET WITH AND W/O TOW
M113A1 AND ITV

**CRIZER TASK FORCE – 1978**

M113A1
IFV/CFV
SPECIAL ARMOR IFV ([illegible])
SPECIAL ARMOR CFV ([illegible])
M113A1 WITH ITV
BMP

**MAHAFFEY SPECIAL STUDY GROUP – 1978**

IFV/CFV – ONE AND TWO MAN TURRET, WITH AND W/O TOW
SPECIAL ARMOR IFV/CFV
ARMORED CAV COMBAT VEHICLE
STRETCH M113A1 W/TURRET
ARMORED CAV COMBAT VEHICLE

**IFV/CFV COEA UPDATE – 1979**

IFV/CFV
M113A2
AIFV (DUTCH)
ARMORED CAV COMBAT VEHICLE

We remain confident that the decision to field the Bradley is correct, but we have been asked by the subcommittee to relook some of the alternatives for the infantry vehicle. A question exists concerning whether the venerable M113, or modernized variants thereof, has really reached the outer limit of its potential? Additionally, the technologies which give us the Bradley's enhanced capabilities may have applications which change the characteristics by which the M113 family was judged (and found wanting).

THE ANALYSIS

Thus, at the request of this committee, we are conducting a war game and cost analysis of these alternatives to the Bradley.

## ALTERNATIVES

**TODAY**

1. CURRENT BFV
   - M2A1/M3A1
   - BLOCK 1
   - TOW II
2. M113A3
   - CAL 50
   - M175 DRAGON MOUNT

**TOMORROW**

3. ENHANCED BFV
   - BLOCK II: IMPROVED AMMO STOWAGE, SPALL LINER, ARMOR
4. 4 M113A3's + 2 ITV's/PLATOON
   - M113: ENHANCED SURVIVABILITY PACKAGE
     - 25MM GUN/1 MAN TURRET
   - ITV: SAME VEHICLE PERFORMANCE AS M113A3
   - FORCE STRUCTURE PLUS UP
     - 24 ITVs TO MECH BATTALION
5. M113A3: 1-MAN TURRET
6. M113A3: CAL 50 + M175 DRAGON MOUNT
7. STRETCH M113A3: BRADLEY TURRET

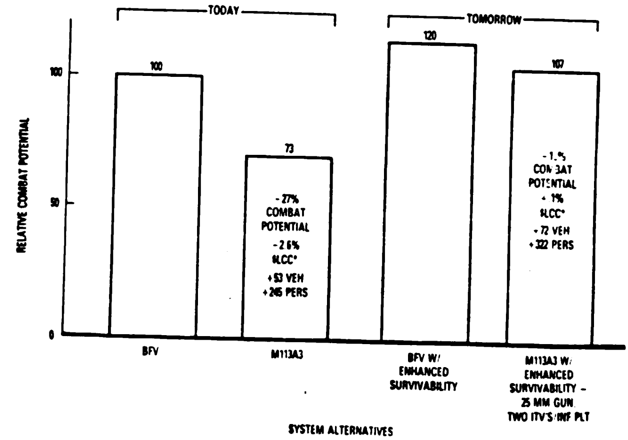
To date, we have completed analysis on the first four alternatives. As soon as we complete the study, we shall provide to the committee, in a separate report, the comparative results of all alternatives.

One model we are using in the anlysis is the Analysis of Force Potential/Measuring Improved Capabilities of Army Forces (AFP/MICAF) model, which provides comparisons in terms of combat potential.

This chart depicts the combat potential of a balanced heavy division (five mechanized infantry battalions, five armor battalions, and one armored cavalry squadron) organized and equipped as shown in the first four alternatives in the previous chart.

## HEAVY DIVISION COMBAT POTENTIAL

AFP/MICAF MODEL
BALANCED HEAVY DIVISION
CLEAR DAY DEFENSE AND ATTACK POSTURE




*LCC - LIFE CYCLE COST

Using the AFP/MICAF model to analyze the alternatives available today - the Bradley-equipped division and M113A3-equipped division - the Bradley is clearly the superior alternative. Equipping a division with the M113A3 infantry carrier alternative results in a 27% decrease in combat potential for a 2.6% decrease in life-cycle costs (LCC). The combat potential and cost analyses include an increase of 53 combat vehicles and 245 personnel for the M113A3-equipped division.

Looking to the future, survivability enhancements to the Bradley made possible primarily by advances in armor technology increase the combat potential of the enhanced Bradley division 20% over today's Bradley-equipped division. If we were to buy an M113A3 with advanced armor and a 25mm gun and if we add two improved TOW vehicles to every infantry platoon in such a division, that division would have 12% less combat potential at approximately the same life cycle costs as an enhanced Bradley division. The combat potential and cost analyses include an increase of 72 combat vehicles and 322 personnel for the M113A3 with enhanced survivability, 25mm gun, and two ITVs per platoon equipped alternative.

Clearly the loss of combat potential which would result from replacing Bradleys with M113A3 or M113A3 variants outweighs these cost consideration levels and the M113 variants would consume more manpower.

THE "ACID TEST" OF THE BRADLEY

But all of the above is merely talk about modeling, testing, and analyses on paper. We shall never know, short of real war, if the assurances which come from the mountain of paper saying the Bradley was/is the right choice are justified. But we have clear indications that we were correct in our judgements concerning the Bradley's contributions. Those indications come from our experience at the National Training Center at Ft Irwin, California. There real soldiers trained to think, act, and fight as Russians battle daily against our modernized and non-modernized forces.

The NTC takes battle out of the realm of computers and adds confusion, fatigue, disorientation, isolation, stress, and all the other unquantifiable human factors which equate to Clauswitz's "friction in war", and "the fog of battle".

We have run six Bradley units through the NTC so far; two more are currently completing a rotation. The conclusions concerning the Bradley contribution to our force are becoming clear. First, an old truism, the effectiveness of a battlefield system is primarily a function of the leadership of the unit: poorly trained and led units do poorly at the NTC regardless of the types of equipment they have been issued. That is an Army training and leadership issue. But factoring out differences in the capabilities of leaders, the availability of modernized systems is proving revolutionary. We have learned that the presence of the Bradley significantly increases the combat power of a task force. The Bradley strips away the enemy's armor-protected reconnaissance elements and forces him to fight blind. The Soviet-like Opposing Forces (OPFOR) knows Ft Irwin perfectly and, consequently, fights better at night than most visiting units. With the Bradley, the night no longer belongs to the OPFOR. Bradley protection significantly reduces casualties assessed from simulated artillery fire. The enhanced long-range armor-killing capability strips away the enemy's BMP's as well as providing an effective long-range tank killing capability. Emerging data shows a 15-22% increase in OPFOR losses compared to friendly losses just as a result of Bradley's presence. Bradley's agility gives superior flexibility and security to a modernized unit. Bradley dashes and climbs better than the M113 and can accompany the Abrams in all terrain. Leaders of M113-equipped units have had to hold back their Abrams to keep their combined arms teams intact. Our analyses said all of this should be true; our experience has shown that it all is true.

We should expect a leader of a Bradley unit to wax enthusiastic about his own unit s successes at the NTC, so I have not brought such a witness. The commander of the OPFOR who has fought both M113-equipped and Bradley-equipped forces is available for testimony from an "enemy's" perspective about what the Bradley has done for our Army.

PRODUCTION

The tested field results are the real reason that the Army is bullish on the Bradley. The following chart reflects the Army's Budget request for the Bradley for 1987.

FY 87 BRADLEY PROGRAM
$ (M)

| | | |
|---|---|---|
| **RDTE** | | |
| SURVIVABILITY IMPROVEMENTS | 19.9 | IMPROVED ARMOR<br>SPALL LINERS<br>AMMO COMPARTMENTS |
| 25MM (AMMO) | 12.8 | ARMOR PIERCING ROUND |
| **PROCUREMENT** | | |
| BFV | 1142.4 | 870 VEHICLES (14+ BNS) |
| BFV (MOD) | 35.1 | 86 RETROFIT KITS (A1)<br>OPTICAL IMPROVEMENTS<br>BLACK OUT LIGHTING |

Research and development dollars are in support of vulnerability improvements and ammunition upgrades to counter the threat. Emerging technologies provide these cost-effective enhancements.

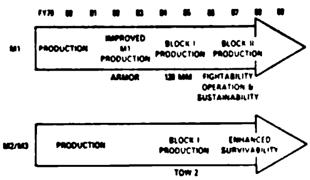
Bradley production has been accelerated to 870 vehicles per yea- in FY87 - FY89 with a buy-out in FY90. All vehicles being procured in FY87 are M2/M3A2's. The key changes in the A1 configuration are incorporation of the TOW II subsystem, installation of a gas particulate filter system, addition of a hatch safety interlock switch, and restowage of some equipment. The vehicles produced with FY87 funds will incorporate, in addition to improved fuel system, fire suppression system, and armored periscope covers previously cut into the FY85 production, those additional survivability enhancements proved effective during Phase II testing. A final decision on the exact configuration of the improvements will be made following the Phase II testing.

SUMMARY

Mr. Chairman, all our past and present analyses and field experience show the Bradley as the clear winner over the M113, any improved varient, or varient mix. The M113's inadequate RAM, growth potential, and mobility characteristics can not compare with the familiar litany of positive firepower, mobility, and protection, force structure savings, etc. Which characterizes the Bradley. Changing back to a less capable vehicle or a mix of vehicles, some of which would have to be developed, tested, approved, and the Army retrained to use, does not make sense from any standpoint. We shall continue to test and improve, as we routinely improve all our equipment, as the threat increases, and technology provides us cost-effective enhancements.

Testing to improve our systems is normal, as is cutting in improvements, and the Bradley is no exception. As you can see below, the M1 tank program has gone through two changes since initial production began in FY79. The Improved M1 allowed for automotive changes followed by the Block I and the introduction of the 120mm Cannon. Your committee did not stop the production of M-1's to incorporate these improvements, rather we continued to field a much needed capability and accepted a mix of our Abrams variants. This has been the history of product improvements in all services with all types of equipment. It makes good sense to follow this same process with the Bradley because the vehicle, as it stands, is needed in the field now.

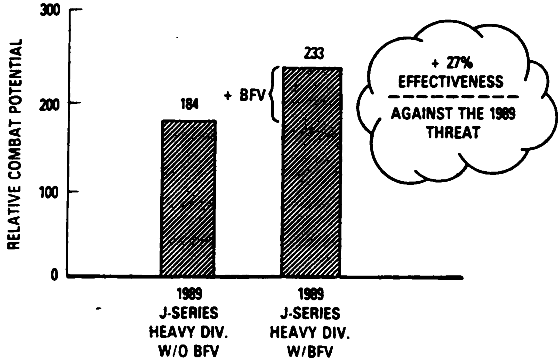
THE IMPROVEMENT PROCESS




So, to conclude, let me state clearly for the record the Army's position on the Bradley Program. The Bradley is an unquestioned success story; it is the best IFV in the world today and is being produced right now at a rate of one battalion a month. The Bradley is solidly supported by the troops who use it and their leaders. The Bradley and the Abrams are our top priorities. We must win the battle at the Forward Line of Troops. Every Bradley unit fielded provides added capability to meet the Threat. The Bradley alone adds 27% to the combat

potential of the modernized Heavy Division. The combat potential of the Heavy Division will increase even further as we add survivability enhancements to the Bradley.

## EFFECT OF FIELDING CURRENT BRADLEY IN A HEAVY U.S. DIVISION




*. . . AND WITH SURVIVABILITY ENHANCEMENTS . . . EVEN MORE!*

Your Army is made up of soldiers ... people ... our nations most valuable resource. Those soldiers survive the rigors of the battlefield better in the Bradley and they win more battles with the Bradley. They can survive and win even better with an enhanced Bradley. Those soldiers need the Bradley as quickly as it can be gotten into the force. On behalf of our soldiers, we seek your continued support for the uninterrupted procurement and fielding of the Bradley and the resources to assist us in making it better.

Mr. STRATTON. Thank you very much.

During the 1978 hearings on the Bradley, the Army explained that the vehicle would be protected against 95 percent of the weapons that were found in a front line Soviet division. Obviously, the threat has changed since 1978. Could you tell us how the Bradley protection might stack up compared to today's threat or the threat for 1990?

General THURMAN. I counted that and I find the numbers somewhere between 85 and 90 percent of the weapons. However, it is true that certain weapons are overmatching. For example, the Soviet tank gun is clearly an overmatching weapon and there are others. So I think that from the point of view of a bean count, the number is still between 85 and 90 percent of the rounds. Lou, do you want to correct that?

General WAGNER. That is correct. There has been one major change, that has been that the BMP now has a 30 millimeter cannon on it instead of the 73, which increases its range. We have learned a lot since that time in how to make improvements in armor and so forth, and I think it is only prudent to all that in our enhancement program.

Mr. STRATTON. Well, thank you very much, General Thurman. I might say that I understand that today is your birthday and we hope that we have not spoiled the day for you. I think your testimony has been very helpful and very effective.

Mr. Courter, do you have any questions?

Mr. COURTER. Yes, thank you, Mr. Chairman.

It is my understanding that the cross-section of the Bradley is relative to, particularly in height, is large relative to the M-1 tank. How much higher is it than the tank?

General BURBA. Six or seven inches.

General THURMAN. Less than a foot.

Mr. COURTER. Less than a foot?

General THURMAN. Yes, sir.

General WAGNER. Ten inches higher than the M-1, sir.

Mr. COURTER. Does that cause any concern for you?

General BURBA. Sir, General Burba from the Infantry School. No, it doesn't. Let me explain why it is higher. You have troops riding in the back of the fighting vehicle. The Soviets look for a soldier that is about 5 feet 7 inches to put in the back of that carrier. That is why the BMP has a lower silhouette. We can't afford that luxury. We take the average American soldier, who has great fighting abilities, to put him in the back of that vehicle.

The other reason the silhouette is higher is that it has the best mobility of any fighting vehicle in the world. It can shoot on the move and has excellent thermal capabilities. When you build that into that vehicle that raises the silhouette. We would much prefer a little bit higher silhouette and greater mobility and shoot on the move firepower in the system. We derive our survivability from mobility and speed and tactics rather than strictly from armored protection. That is why that vehicle is that high. We think it is a very sound reason.

Mr. COURTER. I got, General, from your testimony, that the cost—this is what I really didn't understand—that the cost of the

Bradley, a full complement of Bradley, would be equivalent to the cost of the M–113.

General THURMAN. The M–113, you mean.

Mr. COURTER. Yes.

General THURMAN. I said in the last chart the life cycle costs. You understand the life cycle costs include the manpower associated with it, because in order to get the fightability we had to add the fightability of the TOW missile system on another chassis, which puts up a whole other series of equipments. You might want to throw that chart back up, Mike.

Just to remind you that as you change out the suite in order to get the firepower even at a 12-percent differentiation, you are adding almost 300 people or over 300 people and 72 of the improved TOW vehicles which carry the TOW missile system. That gives you some capability to shoot tanks at a distance.

Mr. COURTER. You are measuring it by firepower, is that correct?

General THURMAN. Obviously, we are measuring the effectiveness of the system in concert with all of the systems that are located in a division, its contribution.

Mr. COURTER. You get more troops with the M–113, don't you, get more soldiers?

General THURMAN. You would have to put more soldiers in that.

Mr. COURTER. That is good?.

General THURMAN. It is not bad.

Mr. COURTER. No; it is not bad.

It is not good?

General THURMAN. No; it is not bad, but the question is——

Mr. COURTER. I thought the purpose was to get troops in the field.

General THURMAN. The question is whether or not you want to devote another 300 troops per division in the infantry role or perhaps you would like to have them in the tank role, or perhaps you would like them in the artillery role, all of which synergistically comes together to field the combined arms team.

General BROWN. The issue of the specific add ons was that in order to give you the same capability that you have right now with the Bradley, specifically 25-millimeter, and the TOW, you have to actually put additional capability into that infantry unit in the form of the improved TOW vehicle and all the people associated with that. A unique, significant, specialized capability without the flexibility that you have right now in the Bradley in that it has both. That was the derivation of the number.

General THURMAN. If you took the Bradley fighting vehicle capabilities out of the vehicle, roughly 370 of them in a division, you would be taking out of the division some 3,000 TOW missiles. Those 3,000 TOW missiles contribute significantly to the attrition of the Red force when he comes toward you. So if you don't want to lose even worse than minus 12 percent, then you are going to have to augment it with something that kills at a standoff range.

The beauty of having the Bradley fighting vehicle is that it combines, one, the armored protection for infantrymen if you want to move them about the battlefield in support of a combined arms attack, and it also provides you with a standoff capability to clean

the other guy's clock before he closes on your position with his armored vehicles.

Mr. COURTER. How many infantrymen can you get in the Bradley?

General THURMAN. You can get into the Bradley a crew which consists of a driver, 2 men in the turret, and 6 or 7 people in the troop carrying compartment, depending upon whether you want a 9 man squad or 10 man squad. We have nine man squads.

Mr. COURTER. Three can't leave the vehicle.

General THURMAN. They fight the vehicle, providing its base of fire in order to support dismounted infantry——

Mr. COURTER. Dismounted infantrymen are six?

General THURMAN. Yes; but you don't fight them usually in sixes. There are a total of four of those vehicles in a platoon. You have a scheme of a platoon of soldiers on the ground that is supported by four very impressive weapon systems.

Mr. COURTER. How many infantrymen can the M-113 handle?

General THURMAN. I suppose it could handle 11 total, a driver, commander, and 9.

General BURBA. Eleven men. So it could hold more infantrymen, but you have to use half of those men to put out the fire support to allow the other infantrymen to perform their function on the battlefield. So you actually end up with an 11-man squad in a M-113, but you end up with fewer soldiers to maneuver and do the other functions that infantry perform on the battlefield.

Mr. COURTER. Fewer soldiers would be able to get out of the vehicle and fight in the M-113 versus the Bradley?

General BURBA. Sir, in the M-113 you would leave one man with the 50-caliber machinegun, and you would dismount 10. You would have to take five of those as a fire support element and put out fire support so the other five could maneuver or breach minefields, and the other roles the infantrymen perform.

With the Bradley you leave three men on the vehicle to provide fire support, and when you dismount the six you can use all of them for your maneuver. So even though you have fewer men in the infantry squad you end up with more men to maneuver and perform the other roles, because of the tremendous firepower you have with the Bradley fighting vehicle.

Mr. COURTER. If you needed that amount of firepower.

General BURBA. Yes, sir; and that is quite likely. In today's very lethal battlefield we think that there is a high probability that you would need it.

General BROWN. The other side is those that you leave in the vehicle have power that is much more projectable than what the individuals do in the M-113. It is not a case of really more efficient and effective, but also much greater flexibility for troops that are dismounted, with the amount of power that has been left with the three in the Bradley.

Mr. STRATTON. Mrs. Byron.

Mrs. BYRON. Thank you, Mr. Chairman.

Let me ask, the Bradley fighting vehicle is an infantry fighting vehicle, right?

General THURMAN. An infantry fighting vehicle.

Mrs. BYRON. Black Hawk is geared for the infantry?

General THURMAN. Black Hawk is a utility transport that is used for infantry and other missions.

Mrs. BYRON. Black Hawk is designed for a 12-man squad?

General THURMAN. Eleven, I believe.

Mrs. BYRON. The Bradley is designed for a nine-man squad?

General THURMAN. Nine or ten.

Mrs. BYRON. Shouldn't they, in the design phase, be designed for a similar number when we are talking about designing vehicles?

General THURMAN. Well, the answer probably is yes; although we made a decision to put 10 men in it—9 men in the Bradley and then added a seat for flexibility, and the Black Hawk goes back before that, so I just——

Mrs. BYRON. In other words, my colleague was just saying basically you are really moving down now to a dismounted squad of six out of a vehicle?

General THURMAN. A dismounted squad of six out of the Bradley fighting vehicle, correct.

General BROWN. Could I comment, if I might, because there is an important distinction.

Mrs. BYRON. I think it is an extremely important distinction as far as I am concerned.

General BROWN. The fundamental fighting element for the light infantry force, which the Black Hawk exists to support, is the individual rifleman himself and all of us exist to support that individual.

In the case of the heavy forces, equipped with Abrams/Bradley, the fundamental combat power is the tank/infantry team combined. It is a different mix of mobility, firepower and armored protection. What we were describing is in terms of the three staying mounted in the Bradley and the six dismounted. Part of that equation is the tanks that they are working with, and essentially designed to give you with the synergistic application of the Abrams/Bradley a total capability that you need, which is a different capability than——

Mrs. BYRON. Last week I asked General Wickham if there was an overall plan. At that time I didn't get an answer, but I understand it has been supplied for the record. In the meantime I guess what concerns me is an overall plan of utilization of the various vehicles.

I think the other thing that concerns me greatly, is, General Thurman, you kept talking about the report that is due to Congress in June.

General THURMAN. Yes, madam.

Mrs. BYRON. It reminds me of the horror story that we went through in this very committee room a year ago when we begged and pleaded with the Army to give us the results of DIVAD, so when we went to mark, we would have those results to substantiate our mark. As you know, we should mark in March. The results we get in June for this committee to mark in March are going to be a little difficult to use.

Let me follow along, because we are on the clock right now. It was reported that the Bradleys were being delivered without the integrated site unit. I asked that question last week and I asked had the problems been corrected. I didn't get an answer, but could you provide us the written information on how many were deliv-

ered without the ISU, how many have been retrofitted, and in your testimony, your presented statement, on page 27, under procurement, you have retrofit kit of $25.1 million.

General THURMAN. Yes.

[The following information was received for the record.]

BRADLEY DELIVERIES

If we go back in history, there have been a total of 238 vehicles manufactured and conditionally accepted without ISU. We schedule the ISU installation so that no vehicle remains on the lot longer than three months. As of 31 January, there were 48 vehicles parked at a FMC Corporation lot awaiting ISU's. We do not retrofit these vehicles. They are built with "holes" in them for the ISU. When the ISUs come in, we place them on the vehicle, test it, and ship it.

Mrs. BYRON. For that. What line item is that coming out of? Who is going to be funding the costs for those retrofits? What is the situation?

General THURMAN. That is for cutting in the TOW II missile system and it is perfectly right and proper. When we cut it in, we did not catch all the previous vehicles because they were going through sequentially.

Mrs. BYRON. How many are going to be retrofitted.

General THURMAN. 355 is the number I recall.

Mrs. BYRON. What about the Bradleys being delivered without the sight-unit?

General WAGNER. As we reported to this committee last year, we have had problems with the integrated sight-unit with the manufacturer—that is Hughes Aircraft which has now been procured by General Motors. We reported last year at that we hoped it would get well by the end of this year. We are still living hand to mouth with that particular piece of equipment.

Mrs. BYRON. Is it well?

General WAGNER. It is not well in my view. They met their requirements last month. They have a goal to get well in April. It is still very close.

Mrs. BYRON. Was it quality control and therefore the responsibility of the contractor or is the Army picking up the tab?

General WAGNER. It is the responsibility of the contractor. In fact, at this time we have even been withholding part of his progress payments until he gets back on schedule.

General THURMAN. He did produce 72 in the month of January. He was required to produce 50.

Mrs. BYRON. How many have been delivered without the sight unit?

General WAGNER. We have 36 that we have accepted with holes in them for the integrated sight-unit equipment.

Mrs. BYRON. Thank you.

Mr. STRATTON. Mr. Mavroules.

Mr. MAVROULES. Thank you, Mr. Chairman.

General, I am going to ask you a number of questions. Because we have a time limit, I won't be able to get them out, so you might want to mark the questions down, then you can respond to me.

What do you mean by overwatch and does it apply only to defense or is it offensive?

Please explain to us your term of cover, when the overwatch was developed. That is one series of questions.

I want to get away from the charts and just ask you is the Bradley going to do the job. Do you have faith in the Bradley that it will do the job?

General THURMAN. Absolutely.

Mr. MAVROULES. What will you tell us in June that you cannot tell us now? Everybody seems to be awaiting these tests in June. Can you tell us now what we can expect in June or perhaps give us kind of an idea? We are supposed to mark up by March 22.

General THURMAN. I think I can give you something to go on. One is the Bradley is essential if we are going to fight and win.

Two, it is perfectly logical to improve it as we go, just as we improve every kind of weapon system known to man—the F-4A is down to G now. So, therefore, improvements are what you want. The improvement that we are going to try to test with the vehicle, rerouting electrical cables, spall liners, all those things which will improve its survivability and reduce its vulnerability.

Will a Soviet 125-millimeter tank round go through it in June? The answer is yes, because there are certain overmatches that clearly will continue to dominate it. If you ask me what is going to happen in June we will make improvements in it, reduce its vulnerability and improve its capabilities in June.

Mr. MAVROULES. Let me ask another question here, General, and of course you will answer the previous ones?

Is the Bradley within budget, is it within the specified time, is it on time? Can you answer me those questions?

General THURMAN. Yes.

Mr. MAVROULES. Have you checked the alternatives, what those could cost and can you give me the strengths and the weaknesses of the alternatives? If you can give me a series of answers to all those questions, I will feel it is a good afternoon.

General THURMAN. First, I think that the Bradley is on time with one exception—the integrated sight unit—and that is due to be corrected in April. It may slip to May. That is one.

Second, I believe it is within budget, but I can stand corrected by General Wagner, who may be more familiar with that.

General WAGNER. It is within budget. Early in the development we had some cost increases. In the last 3 years it has been within our estimates, and we have been able to come in on target. In fact, in the last few years we have actually had savings on it, and have returned dollars on this system.

Mr. MAVROULES. So when you have today's financial figures versus the projected figures, you are saying to me and for the public here today, that it is within budget?

General WAGNER. Yes, sir.

General THURMAN. Correct.

Mr. MAVROULES. If you can answer for me the other questions.

General THURMAN. The other questions are what about its alternatives. The alternatives. In order to come anywhere close to the firepower equations and contributions to the synergy of the battlefield of the Bradley, there aren't any alternatives in the free world.

Fourth, if you want to develop another program you will have to start an R&D program to develop another program.

Mr. MAVROULES. How long would that take?

General THURMAN. It would take a couple of years to develop anything to go through the test wickets you would have to go through. If you say, could you put a TOW and 25-millimeter turret on board a M-113, the answer is you would have to go and upgrade the vehicle, its suspension system, all of its business, in order to make that happen. How long would that take? The answer is it would take you several years. In the meantime you would be forfeiting a production rate of one battalion of modernized equipment per month. So the alternatives are not attractive from a war fighting standpoint.

Mr. MAVROULES. How about the overwatch and cover and when did you develop that?

General THURMAN. Overwatch, let me ask Ed Burba, if I may, because he is an infantrymen and he is intimately familiar with that.

General BURBA. Sir, let me answer your question and tie it into a previous question of Mr. Stratton.

General Thurman has stated to defeat an enemy that is superior in number and has an equivalent technology, we must use maneuver warfare. That is the only way we know to defeat him. In maneuver warfare you avoid frontal engagements because that is where he is strong. His combat power is stronger than yours. You initiate attacks into his flanks and to his rear where he is weakest with his combat power and he is particularly vulnerable with his command posts. You decentralize his command and control and get into his artillery, aviation, logistic support, so you can defeat him from within by avoiding his strength and attacking his weaknesses. For that to happen, two events have to occur. Number one, you have to fix or control the movement of the first echelon forces, regardless at what level. Once that is accomplished, then you can use your tanks along with Bradley, to maneuver into the flanks. Now, previously we couldn't do that because we never could fix him with the infantry force. We didn't have the firepower and mobility we needed to fix him. With the Bradley you can do that, and that frees up the tanks along with a few Bradleys to maneuver into the flanks.

So now, getting down to your question of overwatch. When you are fixing forward echelons you will sit back in covered positions, what we call generically overwatch positions where you are heavily protected. Hopefully you are on the flanks, drawing him into the kill zones or engagement areas where you are very protected and you can attrite a sufficent number of his forces, his tanks, his BMPs, so that it slows him down, if not stopping him completely. Then you are in a position to take your tanks and come around and hit him in the flank and in the rear. So at a very high level that fixing function—which only a Bradley force can do, the M-113 force couldn't do it, the tanks had to do it—we are in an attrition warfare mode. That fixing function is from overwatch positions.

The next thing that has to happen, as the tanks maneuver forward they are going to have to have infantry clearing restricted areas, suppressing antitank weapons, clearing obstacles, breaching fortifications. The Bradley has to stay up with the tank to be able to do that well. The tank can't do those functions very well. That is

why the tank is very naked, as General Thurmond has said, without the Bradley going along with him. During those series of operations, the Bradley will be using cover of the terrain for protection as he goes along with the Abrams tanks. Those are overwatch positions at a lower level. He grabs them as they are available. He stays with them until he can go forward once the tank can bring enough firepower to allow him to go forward.

Now, as you go through those sequences of events, you may have light resistance up against maybe three or four vehicles, no combined arms support, no fortifications. The Bradley will be able to be in the same formation as the Abrams. Some years ago, they said can Bradley fight with Abrams? Yes, he can, in light resistance situations. Other situations might come up against a company, 15 vehicles, combined arms support, artillery, aviation support. At that time, you have to put the Bradley back in overwatch and let the tank try to get forward through covered concealed routes, put enough firepower out. Against heavy resistance, such as a battalion size force, with heavy fortifications, security forces, reserves, echelon in depth, very, very formidable forces, both the tanks and the Bradley will have to go into overwatch. At that juncture, you dismount your infantry soldiers, they go forward, conduct assault to breach in one small area; that frees up the tanks to go forward, and they can exploit that breach. Then you are open and back into a meeting where there is light resistance. So you are using overwatch.

Mr. STRATTON. We are going to have to abide by the time limitations. We have a Member of Congress who is eager to testify. Before he testifies, we want Colonel Burton to testify and at the same time, we want to have all of the members of the committee who desire to ask questions to ask those questions. So I think we have to be rather strict on the red light there.

Mr. MAVROULES. Let me at least thank the gentlemen for giving me those kind answers, Mr. Chairman.

Thank you very much.

Mr. STRATTON. Mr. Skelton.

Mr. SKELTON. General, what happens if you don't have any more Bradleys and you have a conflict, where are we?

General THURMAN. You are going to lose the conflict on the ground. It is an integral part of the doctrine of the U.S. Army and a key item in the combined arms tank, infantry, artillery, close air support battle.

Mr. SKELTON. Now, there have been a series of standards against which the various tests have been applied through the years, is that not correct?

General THURMAN. Yes, sir.

Mr. SKELTON. The first series of tests was against the prototypes, the early Bradley fighting vehicles that were prepared, was that not correct?

General THURMAN. That is correct.

Mr. SKELTON. That was about what, 1979?

General THURMAN. During 1978, 1979, and 1980.

Mr. SKELTON. Timeframe.

General THURMAN. Yes, sir.

Mr. SKELTON. How did those tests come out regarding the Bradley fighting vehicle?

General THURMAN. The tests at Fort Carson, Colorado, in 1979, came out very favorable in terms of its ability to do the job for which it had been produced.

Mr. SKELTON. Was there anywhere where the Bradley fighting vehicle did not measure up in the 1978, 1979, 1980 tests?

General THURMAN. Not to my knowledge.

Mr. SKELTON. Now, of course, as time goes on, we learn that the Soviets are enhancing what they are doing; is that not correct?

General THURMAN. That is right.

Mr. SKELTON. And as a result of what we learn, we are upping our standards, is that not also correct?

General THURMAN. We up our standards and product improve.

Mr. SKELTON. Have you had any series of standards that have been raised for the Bradley fighting vehicle in recent months, days, years?

General THURMAN. We took notice of the fielding of the BMP II.

Mr. SKELTON. That is Soviet?

General THURMAN. That is the Soviet vehicle which now is equipped with a higher powered cannon and more armor and there are increased capabilities. Our standpoint is to be able to penetrate his increased armor capabilities on his BMP, therefore the 25-millimeter gun, with which we have the capability of penetrating his vehicles. There is a constant push and shove like there was on the Abrams tank.

Mr. SKELTON. Against the most recent tests that you have applied, how did they result?

General THURMAN. Against the most recent tests we are still overmatched beyond certain ranges with the Soviet weaponry. That is the reason we are going to do some additional testing in March in order to see if we can up the protection in the Bradley.

Mr. SKELTON. Now, suppose these tests turn out positive, that you do your enhancing, how does that affect your survivability on the battlefield in the present environment as you understand it?

General THURMAN. When we make a change in the Bradley vehicle, either by applying armor, on the exterior, with spall liners on the interior, and increase the speed or increase the weapons performance——

Mr. SKELTON. You explained all of that before.

General THURMAN. We add survivability.

Mr. SKELTON. Let me ask you about aluminum armor. Is this an unusual type of armor?

General THURMAN. It has some laminate quality to it.

Mr. SKELTON. Aluminum itself also is used for aircraft and ships and other vehicles, is that not correct?

General THURMAN. That is correct.

Mr. SKELTON. Well, does this cause a flammable or explosive situation?

General THURMAN. It does not.

Mr. SKELTON. Now, also, is it true that if the Bradley were to be attacked by large caliber munitions, such as 120-millimeter——

General THURMAN. It could be attacked by 120-millimeter rounds.

Mr. SKELTON. Will there be significant damage done?

General THURMAN. There will be significant damage done.

Mr. SKELTON. That would be to just about any vehicle that would be probably less than an M-1 tank, is that correct?

General THURMAN. That is right, whether it is M-113 or a Bradley or whatever.

Mr. SKELTON. Can you ever improve a vehicle like this to withstand such an attack such as by a steel armor?

General THURMAN. You can improve it if you let the weight run up to 65 tons perhaps.

Mr. SKELTON. In other words——

General THURMAN. Sixty tons.

Mr. SKELTON. Then you don't have a Bradley fighting vehicle that can move?

General THURMAN. Well, move with great difficulty.

General WAGNER. You can move it but you certainly couldn't deploy it rapidly around the world.

Mr. SKELTON. You can't keep up with the M-1 tanks?

General WAGNER. With enough horsepower you could keep up, but it wouldn't have the capabilities such as swimming and other things that the Bradley has.

Mr. SKELTON. What I am getting at, so many people seem to want this to have the same type of protective armor and the like as the M-1 tank. This isn't an M-1 tank.

General THURMAN. It is not and it will never have those qualities.

Mr. SKELTON. What then, for those who are uninitiated, tell us again how this is employed, what its use is and why it is not in the category of the M-1 tank?

General THURMAN. It is a vehicle that is designed to both move infantrymen about the battlefield and at the same time provide a substantial contribution in firepower to the combined arms team operating with Abrams tanks and other artillery, close air support and the like.

Mr. SKELTON. It was never meant to be a tank?

General THURMAN. It was not designed to be a tank. It will never be a tank.

Mr. SKELTON. Thank you.

Mr. STRATTON. Mr. Dyson.

Mr. DYSON. Thank you, Mr. Chairman.

General, if you would do us a favor and maybe go into some of these proposed enhancements. I think you know now that in the comparison between the M-113 and the Bradley infantry fighting vehicle, that there is quite a difference in price. I think the one came out about $270,000 a copy versus about $1.2 million. The addition of $65 million that is included in this budget for the survivability enhancements, that is obviously going to add to the per unit cost, and I think in my own opinion, somewhere down the road if we have to continue to live with this Gramm-Rudman, is going to force some kind of a cutback in the numbers that we can procure.

I understand that some of the proposed enhancements deal with the restorage of the ammunition and there is some concern that the design is not complete on that yet, the spall liners, the applique armor packages and some of these other issues.

As has been mentioned by a number of my colleagues, these test results in these proposed enhancements, these decisions, are going to be made by you long after we mark up this defense bill this year. I, as one Member of Congress, find it very difficult that we should even continue if we don't know what effect ultimately some of these major changes may have.

I, quite frankly, am sort of disillusioned. My staff in the office, my personal office, asked me to ask the question if it was at all survivable. Then I get your breakdown here, all of the questions GAO had, test shot results, not representative overall vulnerability, shots into ammunition were excluded, infantry vehicle was not tested, the current threats were not simulated, only two 120 millimeter tank shots were fired.

I guess what I am asking is where are we going, will the $65 million in enhancements, will that help it any?

General THURMAN. The answer is that it will help it substantially and——

Mr. DYSON. Maybe—let me interrupt—are we going to continue to throw money at this? My dear friend and colleague from Maryland, Mrs. Byron, in our last meeting on this said, is this the new Divad? God knows I hope not. We only need one of those a Congress, I think. Where are we going with this, how much more money are we going to put into it. As I say, now the copies are running $1.2 million per copy.

General THURMAN. About $1.2 million. We have indicated that we have already been cutting in some of the improvements we discovered in the first series of tests, which essentially can be cut in at relatively no cost, such as rerouting of fuel, which means when we learn something from vulnerability testing that we are doing something about it.

We asked the contractor, and have been out there and looked at the mockups with the spall liners, if that will help us reduce the vulnerability to it, that will be of assistance to us. There is a substantial investment made in the system and the improvements that we recommend or will recommend, based upon the testing are not unlike a variety of improvements on a variety of items of equipment that are in production. So the answer is that we will run the tests to assure ourselves that we have in fact the right rerouting of cables, and the right revision of fire suppression systems in order to make sure that those are correct.

Mr. DYSON. Since I still have time, I see that again, what our staff has provided us is the restowage of the ammunition, your design is not complete on that is the information they have given us. When will that be complete?

General THURMAN. It will be complete in time for us to look at—we are looking at two different configurations, one is to restow modestly the 25-millimeter ammunition and one is a more dramatic one, which the Department of Defense has asked us to take a look at. I will look at the preliminaries of that on March 9 when I go out to the company to look at that.

Mr. DYSON. Will we know a little more about that before the test results that you are going to send us in June of this year?

General THURMAN. You will know about the first set of restowage and the like. Then there is that phase 2 of the report

and the Secretary of Defense has asked us to look at another phase of it which is phase 2(b), if you like, or phase 3, which would look at even further improvement.

I think that is not unlike any weapon system that is in the service. As I indicated earlier, it is not unusual in aircraft production to run through five or six modifications to the series.

Mr. DYSON. One further question, then I will be finished. When these final test results are in, will they be part of the testing procedure?

General THURMAN. Yes, sir.

Mr. DYSON. Yes, sir.

General THURMAN. Yes, sir. In other words, the phase 2 tests will include the enhancements that I have indicated on the chart.

Mr. DYSON. Thank you.

Mr. RAY. Thank you, Mr. Chairman.

General Thurman and Generals, I appreciate your being here today.

As I understand, the M-113 would carry about 11 troops and the Bradley fighting vehicle about six. Does that mean that we need less troops in the front now when the Bradley is going to take the place of those different troops that we need? With four vehicles you would disgorge 44 out of the M-113 and 24 troops out of the Bradley. I just wondered, that cuts down pretty heavy on the battle troops if that is the only way they are going to have of getting to the battlefield.

General THURMAN. I think that you have to remind yourself of General Burba's discussion. That is, even when you have a larger squad, let's say an 11-man squad, in order to execute fire and maneuver a certain number of the people have to execute the fire in order to permit the infantryman to maneuver. Now, what the Bradley does is because it is so much better—it has so much more powerful weaponry associated with it—is to remain integral to the squad and the three men there are able to compensate for the five that used to do the laying down of the base of fire. The maneuver element is essentially constant—6—in the case of the 11-man squad here, 5 of them are laying down the base of fire, and in this case 6 are maneuvering where 3 are laying down the base of fire. One might say that the vehicle, because of its upgunning and fire superiority, is able to in fact give you a personnel savings.

Mr. RAY. Mr. Stratton mentioned that the Israeli salesman had come by recommending that they could provide this safety equipment, extra security that you would need. The question, I wondered, have the Israelis taken a look at the Bradley. What do they use for instance as a troop carrier?

General THURMAN. They do not use a Bradley. They have used other vehicles, and General Wagner has been over there, let him address that.

General WAGNER. Today their primary carrier is the M-113. You know the problems. If you want to shoot out of a M-113 you have to expose your body from the waist up. They took a lot of casualties in Lebanon they are not happy about.

Incidentally, on their recommendations on armor, that is one we will look at to see how it comes out with the other formulas we have for that.

Mr. RAY. I think it would be helpful if they made some sort of favorable statement about their impression of the Bradley, since they have the reputation of using equipment pretty thoroughly and heavily. Is there a chance they might do that sometime in the future, take some Bradleys and check it out from their viewpoint?

General THURMAN. I don't have any knowledge about that.

Mr. RAY. General, are we maybe responding to the kind of criticism by beefing up, putting $80,000 more in 7,000 more pounds? Could we possibly operate without responding to this recent test?

General THURMAN. In the end game the Bradley, as we now know it fielded in a division, is 27 percent better than any equipment that you could put on the scene. Even without enhancements, back to Mr. Dyson's question, that it would be better to procure the Bradley, even if you put no enhancements on it in order to have a better fighting force.

Mr. RAY. Our plan is to go ahead and put enhancements on it and go back and retrofit the others as well?

General THURMAN. Whether we will retrofit all of them, we will determine that based upon how much money comes down the line.

Mr. RAY. We procured, as you mentioned, one after our requirement. What does that mean in terms of equipping your active units and our National Guard and Reserve units?

General THURMAN. We are about half done, sir, they are one-third done. We have 2,000 in the field, we are looking for a total buy of 6,882 as I recall.

Mr. RAY. You mentioned in your combat effectiveness chart that a 27-percent increase in effectiveness had been accomplished. What is the basis for this combat potential?

General THURMAN. The basis for that is contained in a war game run by the U.S. Army with the current division as it is equipped against a model Soviet force. We took the relative merits between the two and the effectiveness has to do with the equipment located on board the Bradley. Both the TOW and the 25-millimeter cannon is what does them in. A M-113 doesn't have it.

Mr. RAY. Has Bradley been called on to participate in any major field exercises?

General THURMAN. Yes; routinely at the National Training Center, and it was in Europe on the Reforger. A wide number of exercises.

Mr. RAY. You are satisfied so far with the performance?

General THURMAN. It is doing excellently in both performance and materiel, as well as firepower.

Mr. RAY. What kind of soldier acceptance are we getting in the performance?

General THURMAN. I think the soldier acceptance is high.

Mr. RAY. Thank you.

Mr. STRATTON. Mr. Spratt.

Mr. SPRATT. Thank you, Mr. Chairman.

Gentlemen, following up your points about the effectiveness of the Bradley over the M-113, the chart that you show superimposed on the map of Washington, shows the TOW reaching out to the Memorial Bridge, and I would surmise from that that the addition of the TOW is part of the reason the Bradley is much more effective than the M-113?

General THURMAN. Yes, sir.

Mr. SPRATT. But if the Bradley were to acquire a target at that distance, that far out, would it not have to stay on station for some time, train first for target acquisition and then to train and wire guide the TOW into its target? During that period of time, will it be vulnerable to counterfire?

General THURMAN. It would be during that particular period of time, but as General Burba indicated, in overwatch conditions you are going to get into reasonable defilade based upon the folds of terrain. Then so would any other system that would kill at 3,750 meters that we currently have in our inventory, conventional TOW ground launched or whatever you would have that has to stay on target for that period of time.

Mr. SPRATT. As a rough estimate, how much time would it take to acquire a target that was visible at this distance to launch, load and launch, the TOW and then wire guide it in on its targets?

General THURMAN. I believe the answer is 33 seconds. Let's check it out.

General BURBA. That is very close. It takes you about I believe 10 seconds tracking time once you acquired the target. Of course the acquisition time, there is a variety of external stimuli that affect that. We generally feel between 30 and 40 seconds at the extreme range to acquire, track, and hit the target.

General THURMAN. TOW does that under armor and no other system does that under as much armor.

Mr. SPRATT. I think one of you mentioned something about the vulnerability of the Bradley underneath, particularly in its reconnaissance scout mode. Is it particularly vulnerable underneath to mines? If it were out forward on the battlefield on some uncharted territory where mines already are likely to be laid, and if it encounters a mine, detonates a mine, what is the risk underneath both to the vehicle and to the occupants?

General THURMAN. We tested the mines in 1980 and we did run an analysis about that and the requirement says it shall not rupture the undercarriage of the vehicle and the tests were run. It did not rupture the undercarriage, so it passed the test.

Mr. SPRATT. What about the concussion effects inside?

General THURMAN. There are concussion effects inside. One crew member, based upon test data, at his particular station would have had a concussion by doing that. But the effects of the mine did not blow up the vehicle from below.

General WAGNER. There is no question that a heavy antitank mine that will take out any tracked vehicle, will take out a Bradley, and we just can't make it invulnerable to that.

Mr. SPRATT. Let me ask a broader question. Why is it that we just now are addressing these particular problems? I know you have had an ongoing program of testing and looking at it. We seem only now to be coming to grips with the armor vulnerability, with the problem of combustibles inside the troop compartment, with the problems of spall and so forth. We bought 3,607 of these so far, why are we just now in midcourse coming upon these problems and looking at retrofits for solutions?

General THURMAN. First, I don't think we are coming up on midcourse in the line of what we did put down as requirements for it

to meet when the vehicle was developed, and it did meet those in order for us to go into production. I think this is a maturation phase in the case of the Army, we have entered into in terms of looking at the overmatched conditions as well as how to improve. I think that it is right on the value system of cherishing human life to the degree we can improve it.

Mr. SPRATT. If we had had a searching, hard hitting, thorough testing program, live fire testing earlier in development, or right at the conclusion of full scale engineering development, would some of these changes have been made then before we put the system into production?

General THURMAN. I think probably so.

Mr. SPRATT. So that indicates a need for much more thorough testing, much more objective and hard hitting testing later in the late development phases before going into procurement?

General THURMAN. I, for one, believe that the vulnerability testing has been a very useful deal for the U.S. Army. As a matter of fact, I directed the Army to press on and accelerate by 1 year the testing on both the M-1 tank, for example, and I am waiting for our colleagues in the other services to put up an F-18 or a *Ticonderoga* class cruiser.

You understand what I am talking about there, because I will tell you that a torpedo will, in fact, take out a Bradley fighting vehicle every time. So you know, I think we are doing what the Congress would want us to do about that. We are learning something from that. We are trying to improve the vehicle. Meanwhile, it is the very best vehicle that is available in the world market today.

Mr. SPRATT. One further question, for clarification. The figure of $80,000 was given as a cost of the enhancement package you are considering. Is that on a retrofit basis or going forward with new production?

General THURMAN. That is cutting into the new production.

Mr. SPRATT. And the retrofit would be how much?

General WAGNER. We don't know yet, because until we fix up that package and decide what we want to put on it we cannot give you an exact estimate.

Mr. BUSTAMANTE. Gentlemen, where are we with one of the suggested enhancements that was made on the Bradley and that is to place the fuel below the Bradley, do you know where we are on that?

General THURMAN. We have two fuel tanks in there right now. One is an upper fuel cell, which contains less than the main fuel cell, that is located under the turret. The suggestion has been twofold. One is to move it to the exterior. We have elected not to do that, although I am going to go out and take a look at a sample of that.

The reason we didn't put it on the exterior before, one of the criteria for originally putting it up there was to protect it against artillery fragments and therefore, if you put the fuel outside, it is liable to get exposed to that. The other one was to drain the upper fuel tank first vice pumping the fuel in. We have cut that in the May production.

Mr. BUSTAMANTE. It will be somewhere below?

General THURMAN. There still will be two tanks on board, one underneath the turret and the other about halfway up the sponson on the right hand side.

Mr. BUSTAMANTE. Is the one below very vulnerable to a minefield?

General THURMAN. It is, but it did not rupture when we set off the mines, although as General Wagner indicated, you could get an antitank mine, which clearly would cause it some difficulty.

General WAGNER. One key thing is that the fire suppression system in the testing suppressed every fuel fire.

Mr. BUSTAMANTE. On both vehicles.

General WAGNER. On the Bradley, yes.

Mr. BUSTAMANTE. Let me ask you, to place more armor on the Bradley, we are 3 to 6–7?

General THURMAN. Total of all those things would be 7,000 pounds.

Mr. BUSTAMANTE. What effect will that have on the drivetrain?

General THURMAN. The drivetrain would cause the powertrain durability to be reduced. Except we will have a powertrain cut in to enhance its capability, the one that is currently being produced for the multiple launch rocket system. We made the decision last year to put that new transmission system in the Bradley.

Mr. BUSTAMANTE. Can you tell me what percentage of the Bradleys have been incapacitated by the powertrain or drivetrain?

General THURMAN. I would have to get that for the record.

Mr. BUSTAMANTE. I understand there is quite a few at Fort Hood that have been put out of action because of the problems that we have had there.

General THURMAN. I don't recall that, sir.

Mr. BUSTAMANTE. Would you get that for me, please?

General THURMAN. Yes, sir.

Mr. BUSTAMANTE. Thank you, Mr. Chairman.

[The following information was received for the record:]

BRADLEY POWER TRAIN

The Bradley power train consists of the 500 hp Cummins VT903 engine and the General Electric HMPT-500 transmission. Field experience with the engine has been very positive. However, the transmission has experienced a higher than acceptable failure rate during field usage. There is an ongoing transmission reliability Modification Work Order (MWO) effort to install five redesigned components in fielded transmission. This is scheduled for completion by the end of FY 87 and is projected to yield a field reliability increase of 17 percent. In the last year there were two occasions where excessive transmission failure rates were highlighted. This was at Fort Hood in July 1985 (20 incidents) and at Hohenfels, FRC in October 1985 with the 3ID (36 incidents). A review of the hardware failures versus corrective quality and design changes shows that 70 percent of these failure modes have been corrected in transmissions currently being delivered. Thus we think we are on the way to fixing the problem, but transmissions made with early serial numbers will still experience unsatisfactory failure rates. We'll fix them as they come through depot for repair, but it will take time to wash them through the system.

Mr. STRATTON. Thank you.

Our next witness is Colonel Burton.

Colonel, you have a statement, as I understand it?

**STATEMENT OF COL. JAMES G. BURTON, USAF, MILITARY STAFF ASSISTANT, DEFENSE TEST AND EVALUATION, OFFICE OF THE UNDER SECRETARY FOR RESEARCH AND ENGINEERING, DEPARTMENT OF DEFENSE**

Colonel BURTON. I have a prepared statement which I ask be entered into the record. The statement describes the joint Live Fire Test Program. I am prepared in my opening remarks to address the four questions which your staff asked me to address in particular.

I would like to first put my Bradley comments in the context of the overall joint Live Fire Test Program. The statement that I would like to enter into the record describes the joint Live Fire Test Program which is a formal Department of Defense charged joint test. The purpose of the program is to save U.S. lives, by testing to ensure that:

One, U.S. weapons platforms do not unnecessarily endanger their crews.

Two, the weapons U.S. servicemen fire actually stop the enemy.

The program involves testing our front line aircraft such as the F-15, F-16, F-18, AV-8, et cetera, as well as our front line armor systems, such as the Bradley and the M-1A1 tank. It also involves testing our weapons against Soviet armored vehicles and aircraft. The program affects the lives of over 300,000 U.S. servicemen who may have to use this equipment in combat.

The Bradley was the first U.S. armored system to be tested under this concept. Similar tests are now ongoing or about to start on many other systems. The M-1A1 tank tests will begin within the month, as well as tests against Soviet tanks.

Your committee staff asked me to concentrate my remarks today on the Bradley tests, which I will do. I believe it is important to keep in mind, however, that the Bradley tests are only one part of a very large program. Specifically your staff asked me to address four topics in my remarks:

One, what role did I play in the Bradley tests?

Two, what are my views on how the Bradley tests were conducted?

Three, what are my views on the Bradley test results. That is, where do I differ from the Army?

Four, what is going to happen in the phase 2 tests this spring?

With respect to the first question as to the role I played. The joint Live Fire Program was approved in March 1984. Following that approval, I decided that the most important U.S. armored vehicle to test initially was the Bradley, because of the 50,000 to 70,000 lives at stake, and the opportunity to make changes in the vehicle since it was still early in production.

Late that spring 1984, I proposed that Bradley live fire tests be completed that summer. I wanted 25 to 30 shots with real Russian weapons and all shots with the vehicle loaded with fuel and live ammunition on board, and random impact points around the vehicle.

This was the concept I had in mind when I initially put together the joint Live Fire Test Program.

The Army, in response, proposed to test the Bradley in 1986-87 with no commitment to testing with live ammunition on board, and using mostly laboratory devices instead of real weapons. As a result, instead of testing in the summer of 1984, we negotiated all summer. Those negotiations were very intense, and we arrived at an agreement on September 28, 1984.

That agreement called for 10 live fire shots; no random impact points, all dim points controlled; no aiming at internal ammunition, and for the tests to be completed by October 1985.

Once the agreement was reached, a detailed test plan was drawn up that was consistent with the agreement, and I do have to say that the Army conducted the test exactly as they said they would. I have no quarrel with how they executed that test plan, since the test plan was written according to the September 1984 agreement.

With regard to differences in views on the test results, I took the same data base which the Army used to write their report, and wrote an independent report which interpreted that data differently and placed it in a different perspective. I will discuss the principal areas of difference which are particularly important, since they relate to how we modify the vehicle.

The Army and I agree that the ammunition stowed inside the troop compartment is the greatest hazard to the crew and the vehicle. But I go one step further than the Army and say that that must guide the modification packages tested in phase 2 this spring. I emphasize that when internal ammunition is hit, the casualties increase by factors of 2 to 3.

Spall fragments are clearly a major source of casualties. In the 10 live fire shots, spall fragments accounted for three times as many casualties as the penetrating jet. The Army down plays the importance of spall as a source of casualties, but they are planning to test spall suppression liners in the phase 2 tests.

We both agree that the automatic fire suppression system was effective at putting out fuel fires, although it has no effect on ammunition fires. It had a high false alarm rate. For every time it was supposed to discharge, it discharged twice when it was not supposed to.

We disagree on the consequences. All the evidence shows that the troops will be driven out of the vehicle by the contaminated atmosphere inside. This has serious consequences in terms of possibly more casualties and whether or not the vehicle can continue to fight if the troops have evacuated. From this, I conclude that we must arrange things so the troops do not get driven out.

The Army doesn't consider the contaminated atmosphere inside the vehicle a problem, but have agreed to take gas measurements in phase 2 testing to see if the vehicle is habitable following a hit.

There are two subjects left concerning disagreements, overall casualty assessments, and what to do next in phase 2 testing.

We agree that casualties per hit on ammo would be about the same between the infantry version of the Bradley and the Soviet BMP. The Army drops the subject there. The critical factor here is that the Bradley has far more ammunition stored inside and therefore we can expect about two to three times as many overall casualties in combat which leads me to the last subject of difference.

If two to three times as many casualties are important, then we must test a configuration in phase 2 which reduces those casualties as far as possible.

The purpose of the phase 2 tests this spring is to arrive at a modification package which reduces casualties as much as possible. No one says the vehicle can be made totally invulnerable. The modification package should be based upon what was learned last fall in phase 1 testing.

The initial Army proposal for phase 2 tests was oriented toward one particular approach, one that relies primarily on explosive armor concepts and increased armor thickness, an approach which did not consider removing fuel and ammunition from the troop compartment. My position was that that was okay and those armor concepts should be tested, but we must also test a configuration which reduces casualties as far down as we possibly can, and that means a configuration which removes those dangerous materials—fuel and ammunition—from the troop compartment and stores them externally. I call this concept the minimum casualty baseline.

I am not attempting to tell the Army what the right configuration is, but I am suggesting that they will not know the answer until they can compare results from the minimum casualty baseline to the other modification candidates.

I have put my views on this subject in writing and the Army is considering them. They have agreed with me in principle and will in fact test the minimum casualty baseline in phase 2 in addition to the modification packages they originally had in mind.

I also requested that no reports be sent to Congress, and no production decisions on configuration be made until the tests on the minimum casualty baseline are complete and the results compared to the other modification packages. We are still negotiating the details of the phase 2 tests.

That concludes my opening remarks.

## Prepared Statement of Col. James G. Burton

Thank you, Mr. Chairman, for the opportunity to address this committee and explain the Joint Live Fire Test Program. The purpose of this program is, quite simply, to save U.S. lives by testing to ensure that: (1) U.S. weapons platforms do not unnecessarily endanger their crews, and (2) the weapons U.S. servicemen fire actually stop the enemy. This program affects the lives of over 300,000 servicemen who may have to use this equipment in combat.

There has never been a program to shoot real Soviet weapons at U.S. vehicles loaded with the dangerous materials they have to carry in combat; fuel, hydraulic fluid and live ammunition. Nor has there been a program to shoot U.S. weapons against combat loaded Soviet vehicles.

Our weapon systems today are procured with computer-based vulnerability/lethality estimates, little firing data and no full up live firing results. What are the consequences of not conducting realistic-combat live fire testing? When actual combat occurs, we discover, too late, serious shortcomings in our weapons systems; shortcomings which costs lives. There are many accounts from WW II, Korea and Vietnam where U.S. "bazookas" failed to stop enemy tanks due to inadequate warheads. In WW II, Korea and Israel, U.S. tanks proved excessively flammable and vulnerable. The Israeli experience of 1973 showed that the U.S. M-60 burned or blew up twice as often when hit as the British Centurion, and more often than its predecessor, the M-48. Concern over excessive casualties caused the Israelis to make several changes to their M-60s; different hydraulic fluid, fire extinguishers, special armor packages, etc. This painful experience of excessive casualties also led them to a unique armor concept in their Merkava tank which sacrifices the tank in order to protect the crew. In Vietnam, U.S. fighters also proved to be unnecessarily flamma-

ble and vulnerable. Fire and explosion caused the loss of at least 60 percent of the 5,000 U.S. aircraft downed in Vietnam. During the course of the war, survivability improvement kits had to be hastily developed and installed on fighters such as F-4 and F-105 to reduce their vulnerability. In 1982, Congress directed a competitive "shoot off" between candidate modern day bazookas to determine which one the Army would procure for its infantrymen to kill tanks. Six candidates were tested, and a winner was selected, the AT-4. Over 400 rounds were fired during that major competition, yet not one round was fired against an actual tank; not even on an empty tank, let alone one loaded with fuel, hydraulic fluid and live ammunition. As a consequence of not doing combat-realistic live fire testing, we have no idea whether today's "bazooka," tanks or first line fighters have improved this situation. The Joint Live Fire Test Program was initiated by OSD in 1984 to answer this question, and to assist in making sure real improvements happen.

The program was formally chartered by OSD to begin in late fiscal year 1985 and conduct live fire testing of front line U.S. armor and aircraft systems. Soviet antiarmor weapons are being tested against U.S. tanks (M-1, M1A1, M-60) and armored personnel carriers (M-2/3 Bradley, M-113, LAV, and LVTP7). U.S. antiarmor weapons such as LAW, AT-4, TOW, etc. are being tested against Soviet tanks and armored personnel carriers. Soviet antiaircraft weapons are being tested against actual F-15, F-16, F-18, A-V8B, A-6E/F, US-60 and AH-64 aircraft. Conversely, U.S. antiair weapons are being fired against Soviet Aircraft. The program schedule is attached to this statement.

Since the program began in late FY 1985, there has been considerable progress. To date when we have: (1) completed a test to destruction of the F-15/16 engine vulnerability to fuel ingestion, (2) completed three live fire shots of U.S. 105mm tank round against the Soviet T-62 tank. Firings of other U.S. rounds, including we hope, the AT-4 antitank rocket, against T-62s will begin in late February, (3) finalizing the test plan for 50 plus live fire shots against the M1A1 tank to start this March, and (4) completed 10 live fire shots against the Bradley, and the Soviet BMP (Soviet counterpart to the Bradley), and nine shots against the improved TOW vehicle version of the M-113 armored personnel carrier.

Since the primary purpose of the Joint Live Fire Program is to ensure that U.S. weapons platforms do not unnecessarily endanger their crews, let us examine what we have learned about casualties from the Bradley tests. The most important lessons are:

(1) Ammunition stored in the troop compartment is the major cause of unnecessary casualties. When this ammunition is hit, Bradley casualties increase by factors of two to three; the same can be said for the Soviet BMP as well as the U.S. ITV.

(2) Fuel and fire extinguishers in the troop compartment may force the troops out of the vehicle almost every time it is hit, thereby causing greater risk of added casualties. The atmosphere inside the vehicle after a hit is simply intolerable.

(3) Bradley casualties can be significantly reduced. Moving ammunition, fuel and extinguishers out of the troop compartment would provide the greatest combat casualty reductions.

(4) When ammunition is hit, M-2 Bradley casualties are about the same as the Soviet BMP casualties; the Bradley's ammunition presents about three times as much area to hits as does the BMP's ammunition. Thus in combat, greater total casualties can be expected.

Since there has never been a program like this before, it would also be useful to examine what we have learned about the effective conduct of live fire tests from the Bradley experience:

(1) Independent oversight and revision of initial service test plans, where appropriate, is crucial.

(2) Independent on-site observation of the tests and access to all raw data is crucial.

(3) An independent assessment on results, in parallel with the service assessment, is crucial.

(4) There must be no compromise with the principle of shooting real weapons at real combat-loaded targets—despite the vested interests of program advocates and the preconceptions of technical specialists.

There are two final insights from this experience which are worthy of note:

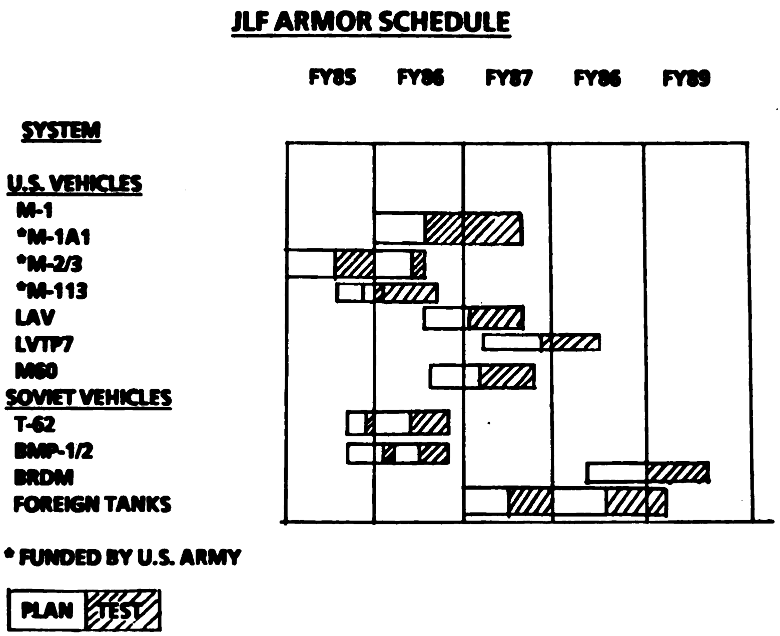
We need live fire testing for every system that exposes significant numbers of servicemen to danger in combat. We need this testing both before the design is finalized, and for the production version.

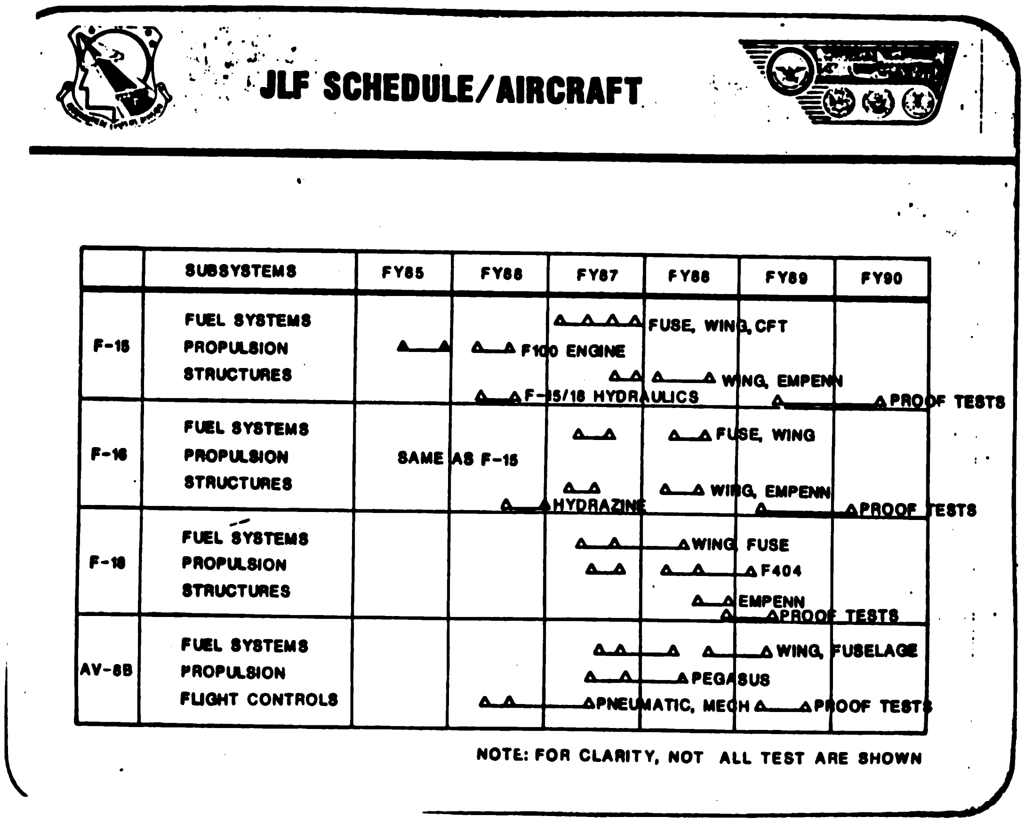
Without continuing year-in and year-out attention from the Secretary of Defense and the funding support from Congress, combat-realistic live fire testing will fade away.

I have one final comment concerning independent reports on test results. I cannot over emphasize the importance of this concept. When we deal with complex situations such as interpreting large amounts of data, in an attempt to decide a proper course of action to improve a weapon system, it is imperative that more than one perspective be put on the table. If two or more independent (I stress independent) interpretations come to the same general conclusion then you can feel more assured that ground truth has been discovered. If the independent interpretations lead to widely different conclusions, then we have a basis for further inquiry. In testimony, January 28, 1986, before the R&D Subcommittee of the House Armed Services Committee, General Thurman, the Army Vice Chief of Staff, agreed with me on this point as it applied to independent reports on the Bradley test results. He indicated that separate interpretations of the same data base was in fact a healthy situation. I quote from his testimony on page 105: "I would submit to you that the analysts can disagree. Not only that, but they should because it is in the disagreement that we develop what is the best interpretation of the data".

#### PURPOSE OF JOINT LIVE FIRE TEST PROGRAM

Save U.S. lives by testing to ensure:
I. That U.S. weapons platforms do not unnecessarily endanger their crews.
II. The weapons U.S. servicemen fire actually stop the enemy.
This program affects the lives of about 300,000 servicemen in combat.
Why is the Joint Live Fire Test Program needed?
There has never been a program to shoot real Soviet weapons at real combat-loaded U.S. vehicles and aircraft (nor vice versa).
Some consequences:
In WW II, Korea and Vietnam, U.S. "bazookas" failed to stop enemy tanks.
In WW II, Korea and Israel, U.S. tanks proved excessively flammable/vulnerable.
In Vietnam, U.S. fighters proved unnecessarily flammable/vulnerable.
We have no idea whether today's "bazooka," tank or first line fighters have improved this situation.
What vehicles and weapons are scheduled for joint live fire testing?




JLF SCHEDULE/AIRCRAFT
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F-15
FUEL SYSTEMS
PROPULSION
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FUSE, WING, CFT
F100 ENGINE
WING, EMPENN
F-15/16 HYDRAULICS
PROOF TESTS
F-16
SAME AS F-15
FUSE, WING
WING, EMPENN
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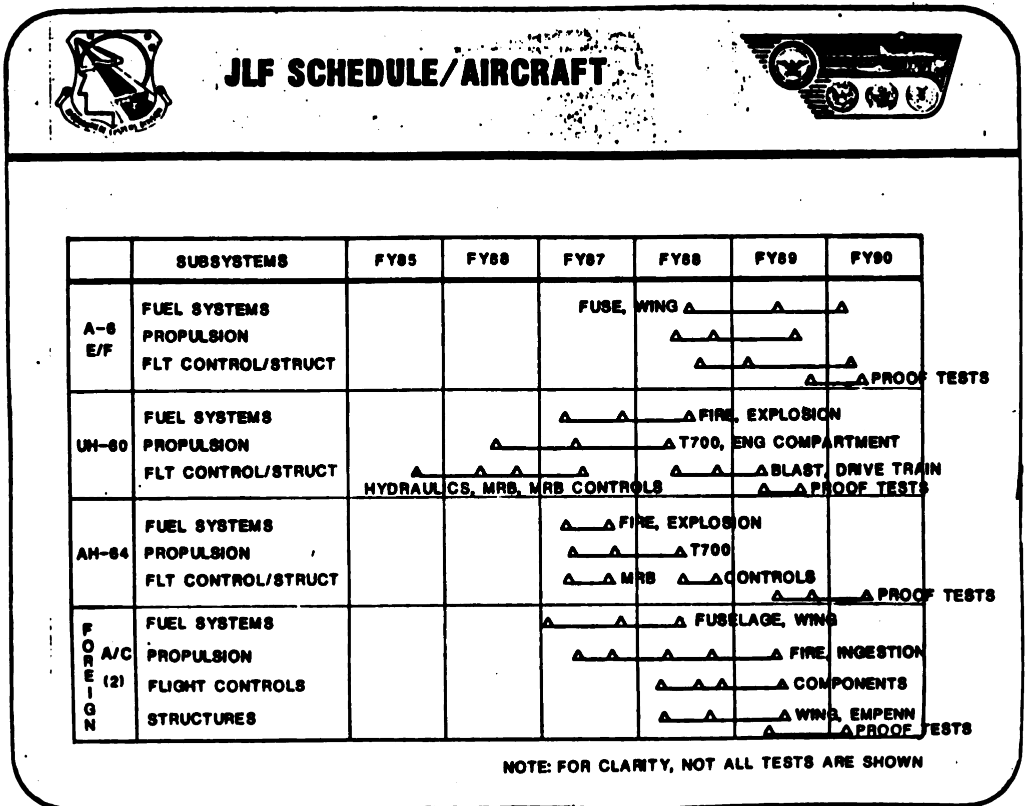
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FLT CONTROL/STRUCT
FUSE, WING
PROOF TESTS
UH-60
FUEL SYSTEMS
PROPULSION
FLT CONTROL/STRUCT
FIRE, EXPLOSION
T700, ENG COMPARTMENT
BLAST, DRIVE TRAIN
HYDRAULICS, MRB, MRB CONTROLS
PROOF TESTS
AH-64
FUEL SYSTEMS
PROPULSION
FLT CONTROL/STRUCT
FIRE, EXPLOSION
T700
MRB
CONTROLS
PROOF TESTS
FOREIGN A/C (2)
FUEL SYSTEMS
PROPULSION
FLIGHT CONTROLS
STRUCTURES
FUSELAGE, WING
FIRE, INGESTION
COMPONENTS
WING, EMPENN
PROOF TESTS
NOTE: FOR CLARITY, NOT ALL TESTS ARE SHOWN

JOINT LIVE FIRE ACHIEVEMENTS TO DATE

Completed test to destruction of the F-15/F-16 engine vulnerability to fuel ingestion.

Completed three live fire shots of U.S. 105MM tank round against Soviet T-62 tank.

Finalizing test plan for 50 plus live fire shots against M1A1 to start this March.

Completed 10 live fire shots against Bradley, Soviet BMP and nine against the ITV version of M113.

What have we learned from the Bradley tests?

What have we learned about casualties from the Bradley tests?

Ammunition in the troop compartment is the major cause of unnecessary casualties:

When ammo is hit, Bradley casualties increase by factors of 2 to 3; same for BMP and ITV.

Fuel plus fire extinguishers in the troop compartment may force troops out of the vehicle almost every time it is hit.

Bradley casualties can be significantly reduced; moving ammo, fuel and extinguishers out of the troop compartment would provide the greatest combat casualty reductions.

When ammunition was hit, M2 Bradley casualties were about the same as BMP casualties; the Bradley's ammunition presents about three times as much area to hits as does the BMP's ammunition.

What have we learned about effective conduct of live fire tests from the Bradley experience?

Independent oversight and revision of initial service test plans, where appropriate, is crucial.

Independent on-site observation and access to all raw data is crucial.

Independent assessment on results, in parallel with service assessment, is crucial.

There must be no compromise with the principle of shooting real weapons at real, combat-loaded targets—despite the vested interests of program advocates and the preconceptions of technical specialists.

LAST INSIGHTS

We need live fire testing for every system that exposes significant numbers of servicemen to danger in combat—both before the design is finalized and for the production version.

Without continuing year-in and year-out attention from the SEC DEF and the funding support from Congress, combat-realistic live fire testing will fade away.

Mr. STRATTON. Thank you, Colonel.

That statement, is that typewritten?

Colonel BURTON. It is handwritten.

Mr. STRATTON. I think we would like to make sure that that is in full in the record.

[Statement retained in committee files.]

Mr. STRATTON. Colonel, you will recall that last December that members of this subcommittee, out of concern over the Army releasing to the press information about the test results of the Bradley vehicle, in advance of reporting to the Congress, that three members of this committee met with you and with the Army on December 17. At that meeting you stated that you were in agreement with the Army report on the major points of the test results.

You stated that, "We had disagreements on very minor items. The differences are a matter of perspective," and you further added, "I don't think there is a major change at all to the overall results."

Do you still stand by that statement?

Colonel BURTON. I believe I do, sir. What I was trying to communicate to you was that the Army report contains a fairly complete and accurate accounting of what happened in those tests. The results are all there, and they are factual. I took those same results

and wrote an independent report in December which placed those results into a different perspective. You asked me to indicate to you the differences between my report and the Army report, because of that different perspective, and that is what I have done here today.

Mr. STRATTON. Do you agree with the content of the Secretary of Defense's report on the testing to include its conclusions and recommendations, and if not, where would you disagree?

Colonel BURTON. The Army report was selected as the official Secretary of Defense report. I wrote an independent report for the Army to critique. The Army wrote a report and I critiqued theirs. Both reports were submitted to my superiors. They selected the Army report to submit as the official Secretary of Defense report.

As I said, I agree with the factual contents of the Army report, but there are differences of interpretation, and those differences have to do with what we do next to impove the vehicle, and today I have tried to point out those differences.

Mr. STRATTON. With what you referred to in your slide as the next go-around.

Colonel BURTON. Yes, sir; phase 2.

Mr. STRATTON. That would represent the modifications that you feel would be desirable for reducing casualties?

Colonel BURTON. Yes; it represents the modifications that I believe should be tested in phase 2. I don't know what the right answer is for implementing those modifications into production. I am just trying to get a full set of candidate improvements tested thoroughly. Because the interpretation I placed on the test results was somewhat different than the Army's, I have suggested that they also test a configuration which has had the ammunition and fuel removed from inside the troop compartment of the vehicle. They have now agreed to do that.

Mrs. BYRON. You said in your testimony you agreed with the internal storage problem of ammunition. Several solutions are being developed and tested in phase 2 which will either reduce the probability of ammunition being hit or reduce the reaction when it is hit.

Do you have a different solution than the one that the Army has come up with and why wouldn't the simple solution be removing the TOW missiles and 25-millimeter ammunition from the troop compartment completely?

Colonel BURTON. That is the one that I have suggested the Army test this spring, that very solution, and they have agreed to do that.

Mrs. BYRON. They have agreed to do that?

Colonel BURTON. Yes; they have agreed in principle. We are now discussing the details of those tests.

Mrs. BYRON. So then you are in agreement with their change for the ammunition on storage?

Colonel BURTON. There are many candidate solutions that will be tested this spring. Everything that is going to be tested probably will not be put into production. There are several candidates. I have suggested that the candidate list be increased by one, and that is the one that has had all of the fuel and ammunition outside the troop compartment. The Army has seen all the test results. I

think they will be in a position to decide which modification package they will actually want to put into production. I doubt that they will put all of them in.

Mrs. BYRON. Well, it concerns me that the tremendous number of changes in orders on the Bradley program that we have seen during the last 3 years, it looks like this spring we are going to end up with a potential for a tremendous number of new changes in orders in the design with the production goal that we have approximately 6,200 vehicles and already 2,000 into the learning curve.

What worries me is these questions I think should have been asked or addressed 1 year or 2 years ago, and I think that is probably where I am more concerned than anything else.

Thank you, Mr. Chairman.

Mr. STRATTON. Mr. Mavroules.

Mr. MAVROULES. Thank you very much.

Mr. STRATTON. Mr. Courter.

Mr. COURTER. That is OK.

Mr. MAVROULES. Thank you, Jim.

Colonel, what is your job?

Colonel BURTON. I am on the Secretary of Defense's staff in the Office of the Under Secretary of Defense for Research and Engineering for Test and Evaluation.

Mr. MAVROULES. Do you work for John Crane?

Colonel BURTON. No; I do not.

Mr. MAVROULES. And what was your participation in the testing and analysis of the results?

Colonel BURTON. As I indicated, when the testing agreement between the Under Secretary of Defense for Research Engineering and the Army was signed in the fall of 1984, that agreement called for my personal participation in the planning and execution of the tests to include onsite observations.

I was the staff officer who staffed the test plan around the Secretary of Defense staff. I point out again, that that test plan was consistent with the basic agreement that we had reached on 10 shots and how they would be conducted. Once the detailed test plan was agreed to, I witnessed most of the tests and all of the live fire tests.

Mr. MAVROULES. You attended all of the live fire tests?

Colonel BURTON. Yes, sir.

Mr. MAVROULES. Let me keep going, because we have some questions. Did you concur with the tests as they were structured?

Colonel BURTON. Consistent with the agreement that we reached in September 1984, yes, I preferred, as I indicated in my testimony, that the tests be conducted differently, but I was not able to persuade the Army or my superiors to do it differently. Once the agreement was made, then the detailed test plan was written consistent with that. I have to honor that agreement.

Mr. MAVROULES. Were you a voting member of the Army's Red Team on the Bradley report?

Colonel BURTON. I participated with the Red Team. I did not consider myself a voting member because I would lose my independence if I did that.

Mr. MAVROULES. Were you involved in the structure of the tests?

Colonel BURTON. Yes; that is correct. Once the overall agreement was reached, I was involved in the final details on how the tests would be accomplished.

Mr. MAVROULES. Were your views heard and considered?

Colonel BURTON. Yes; my views were heard, but not always accepted.

Mr. MAVROULES. Let me ask the final question. You stated your draft report contains two or three minor differences. Please explain those differences for the subcommittee in detail, if you could.

Colonel BURTON. I went through three or four. There are some differences which I consider minor, concerning casualty criteria, whether or not the models were actually validated or whether or not they have any usefulness. I will be quite glad to provide those differences for the record.

Mr. MAVROULES. Would you do that?

[The following information was received for the record:]

DIFFERENCES IN TEST REPORTS

In my opening remarks, I pointed out the principal areas of difference which are important since they relate to how we modify the vehicle. Those principal areas dealt with the hazards of internally stowed ammunition, the importance of spall fragments as a source of casualties, whether or not the vehicle is habitable following a hit, relative overall casualties expected in combat between the Bradley and BMP due to the differences in ammunition presented areas, and which modification packages would be tested in Phase II this spring.

There are other differences which are not as important in comparison. They deal with computer vulnerability models, casualty criteria for blast overpressures, actual number of casualties for the Bradley and the BMP, and the vaporifics issue.

Computer based vulnerability models were used to generate pre-test predictions for all Bradley and BMP shots. During the diagnostic tests prior to the live fire shots, anomalies in the models were discovered which led to three major model revisions. The live fire pre-test predictions were based on the third revision. For the live fire series of 10 shots on the Bradley and BMP, the model predictions were reasonably accurate for 40 and 62 percent of the shots respectively and grossly incorrect for the remainder of the shots. The models failed to predict the vulnerability of electric wiring, the fact that some direct hits on ammunition do not lead to catastrophic explosions or sustained fires and failed to predict structural failures resulting from dynamic warhead blasts on the outside of the vehicle. After three major revisions, the models had no predictive value for individual outcomes. The Army position is that, while the models are inaccurate in predicting the outcome of a particular shot, they are accurate in general when all the results are averaged.

If the models cannot accurately predict the outcome of a particular shot at a particular impact point, then they cannot be used to evaluate the change in vulnerability at that impact point due to a vehicle modification. Unfortunately the Army continues to use the models for this purpose, and as a result have no idea whether the predictions are accurate or not.

There is a large degree of uncertainty in the medical community on what constitutes a casualty. For my report, casualties were defined to include only (1) puncture wounds from the penetrating round and spall fragments, (2) burns, and (3) ruptured eardrums, lung hemorrhage or death as a result of blast overpressures. There is emperical evidence which relates pressures to ruptured eardrums, lung hemorrhage and death. The Army used the same casualty criteria for punctures and burns, but chose to use incapacitation criteria for blast overpressure effects; they did not consider ruptured eardrums as casualties. The incapacitation criteria they chose is known as the Lovelace criteria and is based upon the effects of free stream, open air exposure to a passing pressure wave which is inappropriate for a confined space such as a Bradley troop compartment where pressure waves are complex, reflected and magnified. There have been no experiments or tests to translate overpressures values to incapacitation. The Lovelace incapacitation criteria was subjectively established by a group of medical personnel many years ago. Members of the Army medical community who chose to use the Lovelace incapacitation criteria for the Bradley tests have published technical papers in the open literature in 1982 denouncing that

criteria as unrealistic and one which under estimates casualties. They recommended that a criteria based upon ruptured eardrums as the lower bound be adopted.

The Lovelace criteria requires relatively high overpressures to cause incapacitation. The overpressures generated by the TOW sized shaped charges were sufficient to produce significant numbers of ruptured eardrums for unprotected ears, and therefore significant casualties if ruptured eardrums is used as the lower bound. The tests did not answer the question of whether aluminum armor produces higher overpressures than steel, particularly for the important case of TOW-sized warheads. This is because the steel armored BMP has ammunition explosions during the one effective TOW impact and thus cannot be compared to TOW impacts on aluminum armor where no ammunition was set off. Therefore the vaporifics issue (aluminum versus steel) has not been resolved.

The final difference deals with total casualties counted in the ten live fire tests. My report assessed two additional Bradley casualties for the one shot which resulted in a destroyed vehicle and four additional BMP casualties due to burns on one BMP shot which resulted in a sustained fuel fire.

I must reiterate that these differences concerning models, casualty, criteria, vaporifics and casualty count are minor in comparsion to the differences I addressed in my opening remarks.

Mr. MAVROULES. Finally, just let me ask you a general question. Do you feel, or how do you feel about the performance of the Bradley, what we can look down the road to at this point?

Colonel BURTON. I am not a critic of the Bradley, I am not an advocate of the Bradley, and I try not to engage in dialogue which has to do with whether it is a good system or a bad system. All I have tried to do is to get it tested thoroughly with all of the results put out on the table, and knowledgeable decisions made on how to improve it.

Mr. MAVROULES. Do you have an opinion on the performance?

Colonel BURTON. I have no opinion on that matter.

Mr. MAVROULES. Thank you.

Mr. STRATTON. General Thurman, could you comment on any differences that you might have with Colonel Burton's statement?

General THURMAN. I don't have any differences with his statement. As I indicated in my opening testimony, Mr. Chairman, we have had some interpretative differences on some casualty producers. I think we disagreed on two. He said 63, I said 61. On whether or not your eardrums get blown out or not, whether that is a casualty producer. I think he agreed one way—he had one view, I had a different one.

On toxicity of fumes, all that we said is halon did not produce it, but we have decided to run another test in order to put it to rest.

Mr. STRATTON. As I jotted down what the differences were, it had to do with the internal storage of the ammo, the spall fragments, and the fire extinguisher and the halon effect, which I think you mentioned.

General THURMAN. Right. We agreed with him on fire extinguishers. On spall we understand the nature of spall and one of the things we are doing is putting in the candidate vehicles spall liners. So we are not in harm's way on this one I don't believe.

Mr. STRATTON. And the other one is storing ammo.

General THURMAN. Storing ammo is a very controversial one and the question there is if you move the ammo out, then it is subject to being zapped by overhead artillery. One of the things we wanted for this original vehicle was for it to be protected under armor, including its ammunition. If you put it on the outside, it is liable to get blown up on the outside. It does not contribute to the efficiency

of the battle. On the other side, it may make the vehicle bigger on the outside, then it wouldn't fit in the C-141.

Mr. STRATTON. Has anybody ever suggested that the ammunition for the M-1 should be placed outside?

General THURMAN. Yes, they have, and as a matter of fact, we have put blowout panels on board the M-1—A-1 where the ammunition is stored in the bustle and therefore if it is hit it will blow out the rear and not blow into the crew compartment. It is under cover and it is under armor.

Mr. STRATTON. It takes up a considerable amount of space in the M-1, as a long-time M-1 tank driver myself.

General THURMAN. It does take up space. It is under armor, it does provide enhancement of crew survivability, no doubt about it.

Mr. STRATTON. Thank you.

Mr. COURTER. Thank you.

In your opinion, Colonel, were the tests objective or were they success oriented?

Colonel BURTON. The Army conducted these tests exactly like they said they would. They were not success oriented in this series, in my opinion. As I stated, I believe that there could have been more live fire shots and more randomness, but I lost that argument.

Mr. COURTER. Do you agree with the rationale as to why there was not, why there were not haphazard firings? Apparently all the test firings were aimed at a specific location on the BFV, the rationale being that you want to test a certain part of the vehicle, and therefore, you don't want to have a stray shot. Do you agree with that?

Colonel BURTON. I do not personally, but I agreed to it for this test plan and for this exercise.

Mr. COURTER. How so? You don't agree with it personally but you agree with it in this instance?

Colonel BURTON. The decision process in the Pentagon is very large and very complex. It takes a lot of people to agree on a program like this. My voice was only one of many.

Mr. COURTER. How do you reconcile those two statements? You said you disagree with it in concept but it is OK here?

Colonel BURTON. I personally disagree with the notion of testing in that way. But as I indicated, I lost that argument, and once a decision was made to use that approach, I accepted it.

Mr. COURTER. Is it as good as the other way, in your opinion?

Colonel BURTON. No; I don't believe so.

Mr. COURTER. Can it possibly lead to a success-oriented test?

Colonel BURTON. It could. It most certainly can.

Mr. COURTER. Is it survivable, the Bradley, in your opinion?

Colonel BURTON. There are many weapons it will encounter on the battlefield which will cause it tremendous problems.

Mr. COURTER. Do you agree with the statement that the Bradley is survivable against—I don't know the exact number any more—80 or 90 percent of that which will be fired against it?

Colonel BURTON. If you add up all of the small arms that you might find, I believe those numbers——

Mr. COURTER. My point is, if you had a small arm and you knew it wouldn't kill a Bradley would you fire it at the Bradley?

Colonel BURTON. I doubt that you would. The antitank weapons——

Mr. COURTER. Do you still agree with the statement that it is survivable against 90 percent of that which it would probably take hits by?

Colonel BURTON. I haven't run those calculations myself, so I won't agree with the statement. I don't know what the numbers are.

Mr. COURTER. Are there any issues that require additional tests, in your opinion?

Colonel BURTON. Yes; and we are going to test them this spring in the phase 2 series. Basically they have to do with the gas or the atmosphere inside the vehicle, which configuration packages are the ones that should be tested and looked at. There are a couple of others. I can't recall them.

Mr. COURTER. The fire extinguisher that we talk about in this vehicle, there seems to be quite a fundamental difference between your testimony and the General's testimony. He says it is not disarming and people don't have to go outside the vehicle if it goes off. You say that it is disarming, it is dangerous, and people have to leave the vehicle. Is that just a difference of opinion? That seems like quite a fundamental difference in view of the fact that it misfires twice for each time it fires properly.

Colonel BURTON. Yes, it is a difference.

Mr. COURTER. Can you reconcile those two statements?

Colonel BURTON. I stand by my statement. The atmosphere inside the vehicle after a hit is very foul.

Mr. COURTER. Can you breath in——

Colonel BURTON. I believe not. I have seen people go into the vehicle minutes after a shot and come back out immediately because they couldn't breathe inside.

Mr. COURTER. Yet the Army is saying you can stay inside?

Colonel BURTON. That is one of our differences, and one of the issues we will resolve in the phase 2 series.

Mr. COURTER. Has the vaporific issue been resolved?

Colonel BURTON. I believe not.

Mr. COURTER. I will end with this—what are the other issues that have not been resolved in our mind?

Colonel BURTON. I would like to provide those to you for the record.

Mr. COURTER. Can you name four or five right now?

Colonel BURTON. I think we have been talking about most of them.

Mr. COURTER. Can you just run through them quickly?

Colonel BURTON. Primarily, the atmosphere inside the vehicle, whether or not the vaporific issue has been resolved. No others come to mind. I would like to think about it and give them to you for the record.

[The following information was received for the record:]

UNRESOLVED ISSUES

There are three primary unresolved issues as a result of the Phase I tests.

The most important issue deals with the atmosphere inside the vehicle following a hit and whether or not the vehicle is habitable.

Previous Army tests which I personally witnessed have shown that the aluminum "vaporifics" gasses inside the vehicle following a hit will force the troops to evacuate. Other previous Army tests involving Halon fire extinguishers indicate that Halon in its natural state, as well as the gaseous by-products of a Halon/fire reaction will also force the troops to evacuate. The atmosphere inside the vehicle is intolerable at best and may be hazardous when the "vaporifics" gasses, natural Halon and the Halon/fire by-products are all present and interacting. The Army has agreed to take gas measurements in Phase II to characterize the internal atmosphere to determine whether or not the vehicle is habitable following a hit.

The second issue deals with fuzed versus unfuzed ammunition. All of the live ammunition used in the Phase I tests had inert fuzes. I have asked the Army to conduct an off-line test to determine whether or not the presence of live fuzes would significantly change the violence of the reaction when the ammunition is struck. The Army has agreed to conduct this test in Phase II this spring.

The third issue deals with "vaporifics." The Phase I tests did not answer the question of whether aluminum armor creates higher overpressures (vaporifics) than steel, particularly for the important case of TOW-size warheads. This is because the steel armored BMP had ammunition explosions during the one effective TOW impact and thus cannot be compared to TOW impacts on aluminum armor where no ammunition was set off. Therefore, the vaporifics issue (aluminum versus steel) has not been resolved. There will be an additional BMP test series this summer to resolve this issue.

Mr. STRATTON. Thank you.

Thank you, Colonel.

Our next witness is our colleague from California, Mr. Levine.

Mr. SKELTON. Mr. Chairman, I will forego my questions until after the gentleman has testified, and should I have some questions at that time, I wish to recall Colonel Burton, wherever he is.

Mr. STRATTON. That will be so ordered.

Mrs. BYRON. May I have unanimous consent to be recorded as voting yes to go into closed session?

Mr. STRATTON. Without objection, the gentle lady is so recorded.

Mr. HOPKINS. May I join in on the same request.

Mr. STRATTON. Yes, Mr. Hopkins, without objection, it will be so recorded.

## STATEMENT OF HON. MEL LEVINE, A REPRESENTATIVE FROM CALIFORNIA

Mr. LEVINE. Mr. Chairman, thank you.

Mr. STRATTON. We will be happy to have your testimony.

Mr. LEVINE. Thank you very much, Mr. Chairman, both for holding this hearing and for giving me the opportunity to speak to your subcommittee regarding phase 1 of the joint live fire test on the Bradley infantry fighting vehicle. I appreciate your understanding that I do have to leave in 25 minutes and I am grateful to the members of your subcommittee for deferring some of the questions that they may have for Colonel Burton until my testimony is over.

As the chairman knows, if there is an issue about which I have been concerned since my election to Congress, it has been the Bradley—which more than anything else has made me a military reformer. We hear representatives of the Pentagon bemoan congressional oversight. Yet, if ever there was a case study of why we need such oversight, it is the Bradley and the history of its testing.

When I first suggested that the Army conduct live fire tests on the Bradley, I naively expected that the Army would welcome a constructive, commonsense suggestion designed to save lives and to

save money. Instead, Mr. Chairman, throughout most of this process, the Army has refused even to address these issues candidly.

The first floor amendment I ever introduced was designed to require tests like these on the Bradley. However, efforts to conduct realistic testing of the Bradley went on. That is why we are here today.

While I will not take a great deal of the committee's time, there are a few issues surrounding these tests which I would like to address.

I will not speak directly to the test results. There are many people better qualified than I to analyze. Instead, I want to talk about process, which in this instance could be at least as important as substance—and about the way in which the test results were made public. I also want to discuss the future of the joint live fire testing program.

Last year, as the chairman knows, I introduced an amendment which required the results of phase 1 of the joint live fire test program to be reported to Congress by December 1, 1985. That amendment passed the House on a voice vote.

I want to thank the chairman and the staff of the committee for their help in crafting that amendment. Without their help my amendment would not have been successful.

During the process of drafting my amendment, great care was given to ensure that the deadline which was set was a reasonable one. All parties involved were consulted, and were assured that December 1 was in fact a reasonable deadline. Yet the deadline was not met. Despite the fact that the tests were completed by the first week of October, my staff was told in December that the Army and the Secretary of Defense needed more time to complete their report.

On December 10 my staff learned that the Army was going to conduct a press briefing on the test results. My administrative assistant then contacted the Army and asked if it be would possible for a member of my staff to attend the briefing. He was told that such a briefing was not planned because the test report was not complete.

Imagine our surprise when we turned on the "Today Show" 2 days later only to see films of the Bradley tests which had been provided by the Army at its press briefing.

Mr. Chairman, in my 3 years in Congress I have become accustomed to dealing with the Pentagon. Sadly, I have become accustomed to being ignored. I have become accustomed to being given the runaround. I have become accustomed to being stonewalled. But I have not become accustomed to an outright lie, especially when lives are at stake. Unfortunately, my experience was only the first of a series of misrepresentations and distortions by the Army in reporting the results of the Bradley tests.

While withholding information from Congress and failing to comply with a legally mandated deadline, the Army simultaneously began to conduct its own public relations campaign in the press. I was frankly astonished and deeply distressed by these actions. I hope that the committee has taken, or will take, action to ensure that the will of Congress is not defied again in the future.

At its press briefing, the Army brushed aside the concerns of critics of the Bradley. In fact, General Wagner, who conducted the briefing, said that in the vast majority of cases the vehicle would have continued to fight, that the fire suppression system worked superbly, and that in sum, the Bradley was more survivable than had been expected.

The press was not told that the tests had been designed so that no shots would be fired directly into live internal ammunition. The press was not told that some of the ammunition stowed on the Bradley had inert fuses. The press was not told the fire suppression system had a tendency to go off even when there was no fire, thus making the vehicle uninhabitable, as Colonel Burton earlier discussed. Why did the Army withhold this important information? Was its purpose to hold a press briefing or instead to stage a public relations event?

Unless the Bradley plans to go into combat with inert fuses on its weapons, and unless we have secured an agreement from the Russians that they will fire at the Bradley in areas where their weapons will do the least damage, these actions raise significant questions as to how realistic these tests were and what they really tell us. Once again, the Army has gilded the truth, and perhaps unfairly rigged what were supposed to be realistic tests.

Of course, this is not the first time the Army has played fast and loose with the facts and then misled the public and Congress about the test results. I had hoped the Army had learned from its experience with Divad that it cannot hide the truth, that ultimately the truth will emerge. When that happens, the consequences are invariably worse than had the Pentagon been candid from the start.

There is a reason why tests such as these are important. Real men, made of real flesh and blood, may put their lives on the line riding and fighting in Bradley vehicles. If the Bradley does have shortcomings which make it unfit for combat, it would be a tragedy and a crime if it took the deaths of American soldiers to uncover those shortcomings.

At this time, I want to speak for a moment about Colonel Burton and his contribution to the joint live fire testing program.

If anyone is responsible for even the existence of the joint live fire testing program, it is Col. Jim Burton. Despite tremendous opposition to these tests within the Pentagon, despite repeated threats against him, and despite efforts by some to rig these tests, he has persevered.

The treatment Colonel Burton has received is shameful. Twice Congress has been forced to intercede to keep him from being removed from the joint live fire testing program.

The second time, despite written assurances to the contrary, Colonel Burton was given one week to either accept reassignment to Alaska or get out of the military. Rather than threaten Colonel Burton with the American equivalent of Siberia, the Army—and our country—owe him a debt of gratitude. People like Colonel Burton are a national resource. He deserves praise and recognition, not humiliation and rejection.

The Army's efforts to suppress Colonel Burton's report of his evaluation of the joint live fire tests are disgraceful. First, it denied

that there was a Burton Report. Then, under intense pressure from Congress and the press, it admitted that such a report did exist.

I hope that this committee will do everything it can to ensure that Colonel Burton continues to supervise phase 2 of the joint live fire tests until completion and to prepare his own analysis of the tests. As he indicated, he has not been an advocate or critic of the Bradley, he has simply tried to do a fair and accurate job of testing.

I hope that this committee will do everything in its power to ensure that phase 2 of the tests are as realistic as possible. More men will place their lives on the line riding, and perhaps fighting, in Bradleys than any other vehicle in the Army. We owe it to our infantrymen to give them the best weapons we possibly can.

The independence and dedication Colonel Burton has shown is vital to the success of the Bradley testing program. Without him, there is little doubt these tests would not have been as realistic and useful as they have been thus far.

Mr. Chairman, the credibility of the Congress and the Pentagon is on the line here. The American people have lost much of their faith and trust in our Military Establishment. The only way to restore that trust is by allowing people like Colonel Burton to do their jobs in an atmosphere free from threats and coercion.

The New York Times, the Washington Post, and the Chicago Tribune have all written eloquent editorials on the importance of the Bradley testing program. I would like to include them with my testimony. The fact that these editorials were even written demonstrate that the Congress and the Army will be carefully watched to see how we handle this situation.

The Army cannot save the Bradley and restore its own credibility by misrepresenting the truth to Congress and the American people. The time has come to tell the truth and recognize that brave men's lives are at stake. I hope that 1986 will mark the beginning of a new era of responsibility and honesty in the relationship that the Pentagon has with Congress and the American people.

I sincerely regret, Mr. Chairman, that this process has been as flawed and difficult as it has been and that it has required the type of testimony that I have just given today. But, I believe in the past 3 years that those of us who have been involved in this issue have been trying simply to ensure that realistic, adequate testing be performed. Yet, we have had an extraordinary difficult time simply seeing that what I view as common sensical tests, be performed. I commend you again, Mr. Chairman, for this hearing on this subject, and I hope that we will see that phase 2 is performed in a manner that will provide us with the type of comprehensive answers that we need.

[The following information was received for the record:]

PREPARED STATEMENT OF HON. MEL LEVINE

Thank you Mr. Chairman, for giving me this opportunity to speak to your subcommittee regarding phase one of the joint live fire tests on the Bradley Fighting Vehicle.

As the chairman knows, this is an issue about which I have been concerned since my election to Congress. Mr. Chairman, it has been the Bradley—and the Army's persistent resistance to conduct realistic testing of the Bradley—which, more than

anything else, has made me a military reformer. We hear representatives of the Pentagon bemoan congressional oversight. Yet, if ever there was a case study of why we need it, it is the Bradley and its testing.

When I first suggested that the Army conduct live fire tests on the Bradley, I naively expected that the Army would welcome a constructive, common-sense suggestion designed to save lives and to save money. Instead, Mr. Chairman, the Army has refused even to address these issues candidly.

The first floor amendment I ever introduced was designed to require tests like these on the Bradley. That amendment failed. Overwhelmingly. However, efforts to conduct realistic testing of the Bradley went on. That is why we are here today.

While I will not take a great deal of the committee's time, there are a few issues surrounding these tests which I would like to address.

I will not speak directly to the test results. There are many people better qualified than I to analyze these test results. Instead I want to talk about process—which in this instance could be at least as important as substance—and about the way in which the test results were made public. I also want to discuss the future of the Joint Live Fire Testing Program.

Last year, as the chairman knows, I introduced an amendment which required the results of phase one of the Joint Live Fire Test Program to be reported to Congress by December 1, 1985. That amendment passed the House on a voice vote.

I want to thank the chairman and the staff of the committee for their help in crafting that amendment. Without that help my amendment would not have been successful.

During the process of drafting my amendment, great care was given to ensure that the deadline which was set was a reasonable one. All parties involved were consulted, and were assured that December 1 was a reasonable deadline.

Yet the deadline was not met. Despite the fact that the tests were completed by the first week of October, my staff was told in December that the Army and the Secretary of Defense needed more time to complete the report.

On December 10 my staff learned that the Army was going to conduct a press briefing on the tests results. My administrative assistant then contacted the Army and asked if it would be possible for a member of my staff to attend the briefing. He was told that such a briefing was not planned because the test report was not complete.

Imagine our surprise when we turned on the "Today Show" the next morning, December 11, only to see films of the Bradley tests which had been provided by the Army at its press briefing.

Mr. Chairman, in my three years in Congress I have become accustomed to dealing with the Pentagon. Sadly, I have become accustomed to being ignored. I have become accustomed to being given the runaround. I have become accustomed to being stonewalled. But I have not become accustomed to an outright lie, especially when lives are at stake. Unfortunately, my experience was only the first of a series of misrepresentations and distortions by the Army in reporting the results of the Bradley tests.

While withholding information from Congress and failing to comply with a legally mandated deadline, the Army simultaneously began to conduct its own public relations campaign in the press. I was frankly astonished and deeply distressed by these actions. I hope that the committee has taken, or will take, action to ensure that the will of Congress is not defied again in the future.

At its press briefing, the Army brushed aside the concerns of critics of the Bradley. In fact, General Wagner, who conducted the briefing, said that in the vast majority of cases the vehicle would have continued to fight, that the fire suppression system worked superbly, and that, in sum, the Bradley was more survivable than had been expected.

The press was not told that the tests had been designed so that no shots would be fired directly into live internal ammunition. The press was not told that some of the ammunition stowed on the Bradley had inert fuses. The press was not told the fire suppression system had a tendency to go off even when there was no fire, thus making the vehicle uninhabitable. Why did the Army withhold this important information? Was its purpose to hold a press briefing or instead to stage a public relations event?

Unless the Bradley plans to go into combat with inert fuses on its weapons, and unless we have secured an agreement from the Russians that they will fire at the Bradley in areas where their weapons will do the least damage, these actions raise significant questions as to how realistic these tests were and what they really tell us. Once again the Army has gilded the truth and, perhaps, unfairly rigged what were supposed to be realistic tests.

Of course, this is not the first time the Army has played fast and loose with the facts and then misled the public and Congress about test results. I had hoped the Army had learned from its experience with Divad that it cannot hide the truth, that ultimately the truth will emerge. When that happens the consequences are invariably worse than had the Pentagon been honest from the start.

There is a reason why tests such as these are important. Real men, made of real flesh and blood, may put their lives on the line riding and fighting in Bradley vehicles. If the Bradley does have shortcomings which make it unfit for combat, it would be a tragedy and a crime if it took the deaths of American soldiers to uncover those shortcomings.

At this time I want to speak for a moment about Col. Burton and his contribution to the Joint Live Fire Testing Program.

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The treatment Col. Burton has received is shameful. Twice Congress has been forced to intercede to keep him from being removed from the Joint Live Fire Program.

The second time, despite written assurances to the contrary, Col. Burton was given one week to either accept reassignment to Alaska or get out of the military.

Rather than threaten Col. Burton with the American equivalent of Siberia, the Army—and our country—owe him a debt of gratitude. People like Col. Burton are a national resource. He deserves praise and recognition, not humiliation and rejection.

The Army's efforts to suppress Col. Burton's report of his evaluation of the joint live fire tests are disgraceful. First it denied that there was a "Burton Report." Then, under intense pressure from Congress and the press, it admitted that such a report did exist.

I hope that this committee will do everything it can to ensure that Col. Burton continues to supervise phase two of the joint live fire tests until completion and to prepare his own analysis of the tests.

I hope that this committee will do everything in its power to ensure that phase two of the tests are as realistic as possible. More men will place their lives on the line riding, and perhaps fighting, in Bradley's than any other vehicle in the Army. We owe it to our infantrymen to give them the best weapons we possibly can.

The independence and dedication Col. Burton has shown is vital to the success of the Bradley testing program. Without him, there is little doubt these tests would not have been as realistic and useful as they were.

Mr. Chairman, the credibility of the Congress and the Pentagon is on the line here. The American people have lost their faith and trust in our military establishment. The only way to restore that trust is by allowing people like Col. Burton to do their jobs in an atmosphere free from threats and coersion.

The New York Times, The Washington Post, and The Chicago Tribune, have all written eloquent editorials on the importance of the Bradley testing program. I would like to include them with my testimony. The fact that these editorials were even written demonstrate that the Congress and the Army will be carefully watched to see how we handle this situation.

The Army cannot save the Bradley and restore its own credibility by lying to Congress and the American people. The time has come to tell the truth and recognize that brave men's lives are at stake. I hope that 1986 will mark the beginning of a new era of responsibility and honesty in the relationship that the Pentagon has with Congress and the American people.

WEDNESDAY, DECEMBER 18

The New York Times

Founded in 1851

ADOLPH S. OCHS, Publisher 1896-1935
ARTHUR HAYS SULZBERGER, Publisher 1935-1961
ORVIL E. DRYFOOS, Publisher 1961-1963



# Another Test of Truth for the Army

Another major weapons program seems to be in serious technical trouble. It's the Army's $13 billion program to buy an armored troop carrier known as the Bradley Fighting Vehicle. With almost 2,000 Bradleys already produced, the Army has discovered they are extremely flammable when hit by a standard Soviet antitank round.

An armored truck is a good way to transport infantry to a battle zone. But the Army wanted much more than a battle taxi. It intended the Bradley to go right into battle, fighting and shooting alongside its new M-1 tank. So it put on a roof, and a gun turret on the roof, and a missile launcher to back up the gun. Combined effect: A rolling fortress that costs $1.6 million and is so crammed with ammunition and equipment it holds only seven riflemen.

Even before the Bradley went into production, critics worried that it would be a mobile powder keg. They noted that its fuel tanks and ammunition are located in and around the tightly packed occupants. Also, its armor is made of aluminum, which, when hit, creates explosive vapor and hazardous fragments inside.

The Army ignored these warnings. It refused even to conduct a realistic test of the Bradley by firing live Soviet ammunition at a combat-laden vehicle. When required to do so last year by an Air Force colonel in the Pentagon's testing program, it rigged the test to avoid discovering how flammable the Bradley is. The colonel said shots were changed from agreed positions to "the only possible entry point where the shaped charge would not penetrate stowed ammunition containers" and the test dummies and their sleeping bags "were watered down with a hose to prevent any fires." The colonel was notified he would be posted to Alaska.

Sickened by the Army's behavior, Representatives Mel Levine of California and Denny Smith of Oregon won an amendment requiring that the Bradley be tested realistically. Last week Lieut. Gen. Louis Wagner announced the Army's interpretation of the tests, but not the results.

He said the critics had been proved wrong but that half a billion dollars' worth of safety improvements would be made. That sounds like the critics had a point. Some say the results are even more damning — so serious that the Army has decided to keep the Bradley off the battlefield.

"It would be a pretty dumb commander who would . . . have his Bradleys right behind his tanks." That's what Maj. Gen. John Foss, the Army's chief of infantry, now says. But the Bradley was sold to Congress on just that premise. "The Army feels rather strongly there is an urgent requirement for [Bradley] Fighting Vehicles to fight side by side with the XM-1 tank," Brig. Gen. Stan Sheridan told Congress in 1978.

If the Bradley is now to be just a battle taxi, it doesn't need to cost $1.6 million. An armored truck, costing $100,000, would do the job just as well — in fact much better. Closed vehicles intensify blast, fire and injury when hit by shaped charges or mines, and they can't be easily evacuated. The Bradley is half battle taxi, half light tank, a hybrid inadequate in either role.

Like the inadequate Sergeant York gun, which Secretary Weinberger canceled in August, the Bradley should never have gotten so far into production. As with the Sergeant York, realistic tests, honestly conducted, would have stopped it cold. When will the Army learn? A habit of evading the truth guarantees disaster in battle.

The Washington Post

AN INDEPENDENT NEWSPAPER

# The Fighting Vehicle

THE ARMY has had a difficult year. In August, Defense Secretary Caspar Weinberger cancelled DIVAD, its divisional air defense gun, on grounds it "didn't work well enough." That was after $1.8 billion had been spent. Now a second major item in its procurement budget is under fire, the Bradley fighting vehicle. The Army has already bought 3,000 of a planned 7,000 of these, for about $1.5 million apiece. Two questions persist. One concerns the vulnerability of the Bradley, the other the credibility of the Army.

The Army is now in the midst of the military equivalent of spring house-cleaning, a top-to-bottom modernization program to replace old makes of weaponry and equipment with new. The Bradley is part of this, as was the DIVAD. The vehicle began with a fairly simple purpose; it was to ferry troops into combat, as successor to the Army's old M113 troop carrier. It had to be fast, as Army vehicles go, because the new M1 tank is also fast. Then the Army decided the Bradley ought to be able to "fight" as well, even to the point of knocking out enemy tanks. It was duly equipped with 25-mm cannon and anti-tank missiles.

The elaboration of the Bradley into a fighting vehicle helped drive up its cost, and at the same time made it much more likely to become a target on the battlefield. Cost and this likelihood of exposure combined to accentuate the question of vulnerability—the more so because, to stay fast, the Bradley could not be too heavily armored. There were calls from both Congress and within the Pentagon for realistic tests of the vehicle's ability to withstand enemy fire, particularly given all the fuel and ammunition it would be carrying.

Critics complained last year that the Army—the "armor community," as one Pentagon official sourly put it—was resisting such tests; the Army denied it. A Bradley loaded with fuel and ammunition was finally subjected to anti-tank fire this year. The results have not been released. The Army says the Bradley was never expected to be able to withstand such fire, and did well. But it has also announced plans to build "survivability improvements" into existing and future Bradleys, at a possible cost of about $75,000 apiece.

The non-believers, led by Rep. Denny Smith, who was also a leader in the fight against the DIVAD, say the Army is trying to paper over the Bradley's problems—that, as with DIVAD, the Army tried to make a weapon do too much and is now trying to cover up a mistake in conception. They point to testimony in 1978 in which an Army general assured a congressional committee that the Bradley would "fight side by side" with the M1 tank; now other generals are saying the Bradley should "stand back."

The Bradley appears to have been overbuilt for one of its purposes, underbuilt for the other. That is not an outcome anyone can be especially happy with.

CHICAGO TRIBUNE 10 December 1985

# The embattled Bradley

The Army is in trouble with another big weapons project—the Bradley Infantry Fighting Vehicle, which was designed not only to replace the tried and trusty armored personnel carrier but to fight alongside the Army's high-tech main battle tank.

The Pentagon has already bought some 3,000 Bradleys—at a drive-away price of $1.5 million each—despite continuing and highly-justified criticism. The Bradley is equipped with turret, missiles, cannon, machine guns and jazzy electronics—which make it unwieldy to transport—but it carries only about half as many soldiers as the old armored personnel carrier, while costing three times as much. Also, its light armor is largely aluminum, and it is highly combustible when struck with incendiary shells.

As it should have done long ago, a skeptical Congress finally made the Army put the Bradley through some exhaustive tests last month in which four models of the vehicle were fired on with Soviet-style ammunition.

The preliminary data indicate some very mixed results. As the Army concedes, the Bradley is too vulnerable to perform its original mission of fighting alongside the tanks. That makes a lot of its costly armament and electronics rather pointless. Once again, a weapons systems designed to do too many things can't do any of them very well. The Bradley survived direct hits both well and badly, with results enhanced by the use of fire fighting mechanisms that would not be available on the battlefield.

The Army is afraid of a repeat of the DIVAD debacle, which ended with the cancellation of the entire project when tests showed the anti-aircraft gun still didn't work after more than $2 billion in taxpayers' money had been spent on it. But if in its forthcoming official report to the Congress the Army tries to present only the good side of the Bradley tests, ignoring or hiding the bad results, then the project may end up being junked just like the DIVAD when Congress finds out the truth.

Only if the Army can play it straight, admit the Bradley's shortcomings and suggest some reasonable ways to improve them, will it have a chance to keep the project alive.

Mr. STRATTON. Thank you, Mr. Levine.

Back on the 16th of December, the chairman of this committee, Mr. Aspin, and Mr. Dickinson, the ranking Republican member, wrote to the Secretary of Defense pointing out that we had requested the Secretary to report to Congress the results of the Bradley Fighting Vehicle survivability tests by December 1, 1985. I quote:

> On December 5th, the committee was notified by the Under Secretary of Defense that the report would be delayed until December 20th in order to include data concerning additional testing. Nevertheless, on December 11th, apparently with the concurrence of responsible officials in the department, test results were provided to the press and copies of live fire television tapes were provided for a new broadcast.
>
> Notwithstanding Secretary Hick's letter, the information that we sought apparently is available, since some of the material has been released to the public. We are concerned that selective release of evidentiary material could prejudice the debate of this important matter. Therefore, since the results are now obviously available, we expect the test results to be provided to the committee no later than Tuesday, December 17, 1985. At that time, we expect to receive your findings for the reasons for the names of the officials responsible for the public release of information.

You may be assured that the members who attended on that particular meeting expressed considerable concern and that is the reason why we not only initiated this meeting, but why we have undertaken this hearing as well.

I notice, however, you say that—on the top of page 5 of your statement—"that these actions raise significant questions as to how realistic these tests were and what they really tell us. Once again, the Army has gilded the truth and perhaps unfairly rigged what were supposed to be realistic tests."

I would like to ask Colonel Burton whether you agree that these were unrealistic tests and unfairly rigged?

Mr. LEVINE. Before the Colonel———

Mr. STRATTON. I am asking Colonel Burton. I don't think we ought to have statements of that type made without an accurate response—you can comment Colonel Burton. We are going to find out, he is the gentleman that you are praising, but has Colonel Burton been involved in these unrealistic tests? Are those unrealistic tests, Colonel? Are you gilding the truth and were the tests unfairly rigged when they were supposed to be realistic tests?

Colonel BURTON. I can not comment on unfair rigging. I don't believe that they were unfairly rigged. As far as realistic is concerned——

Mr. STRATTON. What are realistic tests and what are unrealistic tests?

Colonel BURTON. Realistic tests to me——

Mr. STRATTON. The ones that prove what you want to find that somebody else doesn't want to find?

Colonel BURTON. No, sir. I was not looking for anything——

Mr. STRATTON. I am trying to find out what Mr. Levine is talking about. He is praising your activities and at the same time saying the Army has unfairly rigged these tests. If we are going to have tests in phase 2, how are we going to prevent them from being unrealistic?

Colonel BURTON. Make them more realistic with less control on the impact points, more randomness. When we negotiated a test plan for phase 1, part of that negotiation involved a second series of tests which never occurred. I wanted random impacts, and shot

from an operational distance, aimed at the center of the silhouette of the vehicle. To me that was realistic. I wanted shots all around the vehicle in 30 degree increments. That is what I argued for.

The test plan was written such that if they did not lose a vehicle during the first 10 shots, in which they controlled the impact points, then we would do those random tests around the vehicle. That to me was realistic. It was the best agreement I could reach with the Army. During the course of the 10 shots in which the aim points and the impact points were controlled, they lost one vehicle so their commitment to me was met and we never did get to the random shots.

During phase 2, I would like to see more randomness, less control on impact points, so that the results cannot be interpreted as success oriented, as Mr. Courter indicated.

Mr. LEVINE. That to me supports the concept that these were unrealistic tests, with all due respect, And if I might add one sentence, Mr. Chairman——

Mr. STRATTON. Just a minute.

Colonel, does that mean that you believe that the tests are not realistic? Yes or no.

Colonel BURTON. In some sense they are not when the aim points are controlled and the impact points are controlled.

Mr. STRATTON. You can't have it both ways—in some sense——

Colonel BURTON. Live ammunition and fuel was on board. This was the first time that has ever been done. That is far more real than any testing in the past. In that sense, it was realistic. The aim point and the attack directions were not realistic because they were controlled. They were controlled to resolve uncertainties. There were no aim points selected to intentionally strike ammunition inside the vehicle. That part I believe is unrealistic.

Mr. STRATTON. Well, you have previously stated that there were disagreements on minor items, the differences are a matter of perspective, and I don't think there is a major charge at all. How can you have it both ways?

Colonel BURTON. You are talking about interpreting the test results. I am talking about the conduct of the tests.

Mr. STRATTON. If the tests are not realistic, then there is very little that you can get from them.

Colonel BURTON. No, I disagree with that.

Mr. STRATTON. How can you get test results from unrealistic tests?

Colonel BURTON. I would disagree with you that there is very little you can get from them. We learned quite a bit from these tests even though they were unrealistic. General Thurman testified that they were very valuable to the Army. They have learned a lot of things.

Let me just cite a few things that have been learned. We learned for sure when internal ammunition is struck, casualties are two to three times as great as when ammunition is not struck.

We learned about the automatic fire suppression system, that it doesn't work like they thought it should.

There is a long list of things that were learned and they were valuable findings.

I believe it could have been more realistic, but at that point in time, in the fall of 1984, I was not able to secure more realism.

Mr. STRATTON. You mean if somebody doesn't get killed it is not a realistic test, is that it?

Colonel BURTON. I don't believe that is what I said, sir.

Mr. STRATTON. Well, General, can you respond to this question of whether these are realistic tests or unrealistic tests? Has the Army been lying to the Congress and has it gilded the truth? It is going to be your people that are going to be involved in these machines, is it not?

General THURMAN. The Army is not lying to the Congress. The Army has not rigged the tests, and we haven't suppressed anything that Colonel Burton wishes to say. I categorically reject that. Now, I think it is useful to describe the conduct of the tests so we make sure that one understands the way in which we did the tests, which is clear. You can put the tests up on a random basis and fire at it from 3,000 meters, and you may miss the target. So the way we constructed the test is—that would be a waste of the round on the one hand and on the other hand, if you struck a portion, that there was going to be a catastrophic event. And we already stated that if you put a round into the TOW motor or round in the TOW warhead, or a round into the 25 millimeter high explosive, that you will get a catastrophic event. So, knowing that going in, the question is, then how can you put the tests up so that when you fire one, you can actually get some new information that you did not have already in your vulnerability assessment.

All of the tests that were used have been included in upgrading the model under which we try to describe the vulnerability of the equipment. The test is a spot report. If you want to look at how the vulnerability is described on the vehicle, if you will turn to the classified annex of contents of the Bradley test report, you will see some overlay diagrams that would express to you the vulnerability of the equipment.

I think the main difference between Colonel Burton's approach—and I will let him amplify if he chooses to—and ours, has been we know certain information. We know if it hits a principal weapon, like I described, you get a catastrophic event. Therefore, knowing that going in, we are trying to develop all other kinds of information about that.

The question is, how many vehicles do you want to shoot up, how many rounds do you want to shoot in order to get the randomness that you may have? Each weapon system, whether it is an RPG–7 or anything else, has a circular error probable that can give you different results. To give you an example:

On TOW shot No. 2, which is on the chart, one of the charts I showed you, it missed the impact point by 5 inches. We had to redo the shot on a static basis. So there is a case where we missed by only 5 inches given the randomness of the performance of the warhead. Similarly, that would be with any kind of ammunition at whatever range one shoots. So we have a combination of static and dynamic tests. In this case, we shot eight dynamic tests and two static.

I think those are the things that analysts will disagree about but it hasn't got anything to do with rigging tests. We haven't rigged any test, with all due respect.

Mr. LEVINE. May I say a sentence or two?

Mr. STRATTON. I would like to have you address one specific test that bears out your statement that these are unrealistic and the Army has gilded the truth of what were supposed to be realistic tests. What are the tests that you have found to be unrealistic?

Mr. LEVINE. Mr. Chairman, there are two aspects of what I have been trying to testify to. The most significant point, frankly, of it is that when a press briefing is conducted which does not provide the context in which the tests were conducted, and which provides to the press and the public the implication that there are complete answers, a comprehensive set of answers available to a very critical, significant vehicle such as the Bradley, that is a misrepresentation.

And my concern, Mr. Chairman—if I could be allowed to answer your question—is that Congress had a process established and yet the Army did not come back to Congress and tell Congress what the results were. Instead, it went to the press and strongly implied that these results were based upon realistic tests, realistic joint live fire tests. We have just heard from Colonel Burton that he has no problem with this analysis, given what the tests were designed to accomplish. However, the important point to remember is that these tests themselves were not random. They did not give us an accurate reflection of what would happen on the battlefield; they didn't provide us with the kind of information that would replicate battlefield conditions, therefore, Mr. Chairman, the Army is suggesting to the press and to the public a set of results that frankly are not yet in.

Nothing would please me more than if, in phase 2 of these tests, we came to the conclusions that the Bradley performed very well with regard to all of these issues. But you cannot fairly, honestly and accurately go to the press after phase 1, when phase 1 is conducted within the constraints that Colonel Burton outlined, and provide information to the press and to the public indicating that we have comprehensive answers. We did not. We do not.

The jury is still out. We don't have the information, and why I say that the Army has misled the public is because the Army went to the press, had the press briefing, didn't go to Congress, and provided the press with a set of assumptions and a set of conclusions that are not justified by the test results.

Mr. STRATTON. What are the test results that you think are not realistic and not truthful?

Mr. LEVINE. We don't know, Mr. Chairman, how survivable the vehicle is. We don't know, Mr. Chairman, whether or not the fire suppression system is going to force our infantrymen out into the field.

We don't know, Mr. Chairman, what is going to happen if you have live fuses on the ammunition. We don't have those answers that the Army in its press briefings strongly implied to the press that we do have.

Mr. STRATTON. What about that, General?

General THURMAN. I am ticking them off. Regarding the fire suppression system with the halon, the practice orders the crew to mask. If indeed they have a problem that they can't contain, each guy has his own gas mask. As a matter of fact, the tests conducted show that because of the entry of a weapon into the cargo troop compartment of the vehicle, you automatically begin to vent it, because of the pressure that is built up in there. So we have said, based on the evidence of the tests we have run, that we don't believe that the halon is a problem. We do have, as an added measure, that the crew will continue to operate by masking.

As we have agreed with Colonel Burton, we will continue to run the tests even again, to see if there is some mixture of various and sundry elements of gases. If there is something there, we will test it out.

On the live versus inert fuses, we have already declared to you on the tests, on the chart that I showed you, that if you hit the high explosive round in its box, it will explode if you hit it with an overmatched piece of ammunition. If you take the inert—if you make the fuse inert—it will still explode, therefore, it is a moot point, it has nothing to do with what happens in there.

Finally, in the case of the inert fuse, once it is located in the chute, or live fuse in the feed chute to the high explosive round, we have conducted propagation tests that show that a maximum of three to four rounds will propagate and it stops. So from our standpoint, we have already determined that a 120 heat round or a RPG-7 or a weapon of that caliber will in fact explode the HE fuse.

The third item you said, sir, was?

Mr. LEVINE. Both on the fuses, but Mr. Chairman, with all due respect, his testimony with regard to the fire suppression system sounded very different to me from the testimony of Colonel Burton. With regard to the inert fuses the point that I was making, was simply that the press didn't know that we were dealing with inert fuses. The press was operating under a set of different assumptions in the context of this press briefing than were the fair and full assumptions that the press should have known about.

These were a series of statements made to the press out of context. They were made to the press when, we were specifically assured by the Army, the information wasn't available. We were told the information wasn't available. But, at the same time, it was released to the press.

Mr. MAVROULES. Let me interrupt for a moment.

Mr. Levine, back when we had the Divad, if you recall, Mel, the Secretary kept us on a string for a long time relative to notification. He notified us simultaneously as he went on to the press. It is nothing new. There is such a thing as grandstanding even in the military. I may say that, but it is a fact of life.

One question though I have got to ask, I have to get the truth here. I am going to ask you, Colonel, because Mr. Levine I believe referred to you. Do you think at any time that the military has been misleading the Congress on this issue? I want your honest opinion.

Colonel BURTON. I have to think about that.

Mr. MAVROULES. You know we have to have that. We have these open hearings. If we were misled, I want to know about it.

Colonel BURTON. I don't know of any intentional misleading to you.

Mr. MAVROULES. I am talking about the Army, have they misled this Congress on the Bradley?

Colonel BURTON. They presented to you a test report which contained an accurate summary of what happened although I don't agree with their interpretation of the results. I can say no more on that subject. I have not been present at all of the hearings, so I am not aware of everything that they have told you. I have sat in on two hearings, this one and the R&D Subcommittee hearing, I have listened to General Thurman testify and I have no trouble with his testimony in either of those two hearings.

Mr. MAVROULES. General, have you misled the Congress, you and the Army?

General THURMAN. No, sir.

Mr. MAVROULES. Mel.

Mr. LEVINE. I appreciate your asking the question because I think it is an extremely important question and it is a sensitive, difficult and tricky area. I have, as I am sure every Member of this body does, on both sides of the aisle, nothing but admiration for our Armed Forces. What frustrates me, in dealing with these issues, is that when we have a statute, passed into law, without a dissent in this instance, which requires that a particular report be made ready and available to Congress on December 1. Yet, when we call and ask several days after that report is late, whether or not we can get that report, we are told it is not ready, when in fact it was ready in October.

And second, we asked the Army for permission to attend a press briefing on the subject and were told there would be no press briefing, because the report is not ready. To then see films of the briefing on the "Today Show" is particularly frustrating. With all due respect, that is not candor, that is not openness, that is not being responsive—either in terms of providing the information itself, or in terms of the responses that we received to specific questions.

Mr. STRATTON. Mr. Dyson.

Mr. DYSON. I have a question or two I would like to address to Colonel Burton.

I believe you said that during these test reports, as they were contrived, were in fact accurate, they were not the way you would have done them, and I think you also said that during one of these tests they lost a vehicle. If there were nonrandom shots, more random shots, that you would have preferred, how would the Bradley have stood up in your opinion?

Colonel BURTON. I am not quite sure how that would have turned out. I suspect there may have been more catastrophic events.

Mr. DYSON. Another question, I thought I heard you say you were asked to critique the Army's report and they in turn critiqued your report.

Colonel BURTON. That is correct.

Mr. DYSON. What happened to yours? I gather also from what you said that the Secretary of Defense accepted the Army's report and that eventually became his report. What happened to yours?

Colonel BURTON. It was finished, that was it. I submitted it to my superior, and it stopped there.

Mr. DYSON. Was any of it incorporated in the Army's, what ultimately became of the Secretary's report?

Mr. STRATTON. Are you with Mr. Levine? Would you get him back? Mr. Courter has a question for him. He just walked out of the hearing room. A member wants to ask Mr. Levine a question. I think he has every right to. Tell him we want him back.

Mr. DYSON. Could you answer that?

Colonel BURTON. Yes, the Army report went through four, or five or six iterations before it was completed. There was a red team appointed to critique it. They invited me to participate as a member of the red team. At the same time the Army was writing their report, I began writing one. The red team critiqued both reports. Many of the points I raised in my report were addressed in the Army report because I raised them. I raised the issues and a lot of them were incorporated into the Army's report; many of them were not. There were still differences and we have gone over what those differences are today. It was a back and forth interative process. I would raise an issue, they would either address it, refute it, or incorporate it, and many of the things I raised wound up in their report.

Mr. DYSON. If they were issues involving survivability, that would be a significant issue, would it not?

Colonel BURTON. Yes.

Mr. DYSON. Were some of them excluded?

Colonel BURTON. Not excluded, but not——

Mr. DYSON. Were they not given the emphasis you felt should be?

Colonel BURTON. That is correct. That is what I tried to indicate to this committee. I took the same data base and put a different interpretation on it, more emphasis on people and casualties—what the results mean in terms of the effect on the people that use the vehicle. The people came first, the vehicle came second. I believe that if you read their report you will get the opposite view. They place more emphasis on the vehicle and its problems and less emphasis on the casualties and the people. They don't ignore that aspect but the emphasis is far less.

Mr. DYSON. One other question. In the proposed enhancements, the proposal in this budget, is what, $65 million? If that would come about how would you recommend the Army change its testing?

Colonel BURTON. Change its testing?

Mr. DYSON. With the enhancements? Obviously the Bradley is going to be better if this comes about?

Colonel BURTON. Yes, sir. With regard to the phase 2 or testing in general?

Mr. DYSON. Well, I think—of course this is my word—but I think you would agree that tests before were somewhat contrived rather than more random in the area of just, for instance, the shots directed at the Bradley. Is that an area they ought to look into when they go into the phase 2?

Colonel BURTON. Yes, sir, absolutely.

Mr. COURTER. I am trying to make sense out of this afternoon. I am not sure whether I am getting any place.

I am sorry that Congressman Levine had to leave because I have some observations I wanted him to hear. I certainly do appreciate

his testimony. He spoke with all candor and integrity from his position.

It seems to me, however, rather inconsistent to criticize the Department of Defense, the Army, in this particular instance, for going to the press, which really is going to the American people. At the same time, I am sure that we, all Members of Congress, run to the press when it advantages us.

I am sure that the Army knows that the Congress will show its bad side and, therefore, it has an obligation to show its good side and that really isn't a basis for criticism of the Bradley fighting vehicle.

I found much of the Congressman's testimony interesting, but really not relevant to whether this is the best piece of equipment for the field or not. What is the alternative? The two or three areas that he talked about concerned basically the issue of survivability, and it seems to me that when you talk about survivability, you would really have to talk about the survivability of some other systems, like the M113. I don't think that Mr. Levine or anybody else would testify that that particular vehicle was more survivable than the Bradley.

It struck me in the very beginning that Mr. Levine's star witness, Colonel Burton, disagreed with him, and I thought that was quite obvious. Mr. Levine characterized the tests as unfair, success oriented—he used stronger words than that.

Colonel Burton testified that the tests were not success oriented and that they were fair and that the results were reported accurately, and basically I end up this afternoon with kind of a mixed situation. I see really no testimony that would lead me to believe that the Bradley is not capable of doing what it can do. I certainly am very interested in seeing the second phase of the tests. I am a little bit concerned about the fire suppression system and a couple of other things. I would like to see random shots and not aim points directed.

But I think the Congressman's testimony expressed his irritation at being ignored rather than the merits of the vehicle itself. I am sorry he is not here to hear that.

Mr. STRATTON. Anyone else?

Mrs. BYRON. Let me reflect a little bit on the hearing this afternoon. The thing that concerns me is I can recall 5 years ago when I went out and had an opportunity to watch the Bradley in the field, to operate it personally, and to be involved in the system at the time, I don't recall over the last couple of years hearing much controversy over the Bradley up until maybe a 1½ ago.

I think we all are agreed that the system is one that is desperately needed. It is a system that in my estimation, in my mind, is already fielded with our troops. I think we have seen a tremendous number of change orders in the system in the last few years. Any time change orders come along you increase the costs. The two new buzz words up here are Gramm-Rudman. I think we are going to have an awful time with a mark with that in mind.

I hate to see this system go through what we saw the Divad go through a year or so ago. I just cannot say enough times that I think we saw some misleading information or test results come through from the Army on Divad. I think we saw some tapes that

weren't—I can't use the word doctored tapes but they were half tapes, they didn't show both sides of the issue. I think we saw some photographs that were only half of the story.

I just want to reiterate and stress and say whatever effect that I have that I certainly hope that when you come back to us with the results of phase 2, they are above board, they are honest, they are accurate tests, to the best of our ability, and you have to tell us both sides of the issue, because it is much harder to repair the damage once it has been done with half truths on testing. So, from one member of this committee that still is agonizing over Divad, because we still need the system, I don't want to see the same thing happen to the Bradley.

I think there are problems. I think they are problems that can be corrected. When we are talking about correcting those problems, we are going to have to be looking at it with a cost effectiveness involved in that. Would we be better with the existing Bradley without increasing the amount of armor? Would we be better with the existing system without making some of the corrections that we have talked about here, adding armor which increases the weight which then you have to put in a new engine, which then makes it not be able to move in its original concept. This gets to be a little bit ludicrous. Please just give us honest, above-board results.

Thank you.

General THURMAN. May I offer one comment?

Mr. STRATTON. General.

General THURMAN. I would like to distinguish between York and Bradley. The York did not meet its original design requirements. The Bradley did that. Now, what we are trying to do is to improve that, which again is the product improvement process that has gone on in our Armed Forces for a substantial period of time.

Mr. STRATTON. Mr. Spratt.

Mr. SPRATT. Thank you, Mr. Chairman.

Colonel Burton, you stress in your conclusions about what was learned from the Bradley, a number of different things, and each one of them stresses the need for independent oversight, independent oversight observation, independent assessment. The word independent stands out, yet when you talk about the testing regimen program or protocol that you carried out, you speak of having to reach an agreement with the Army, of having to negotiate with the Army.

Is OT&E, the Office of Testing and Evaluation, not able to write its own programs, its own protocol and impose that requirement upon the services and military departments?

Colonel BURTON. That was the case. This was during the time that there was no OT and E office, before it began.

Mr. SPRATT. Are you now part of that?

Colonel BURTON. No, I am not. I am still in the development side of the house, USDR&E. The program remained there when the new office was formed. This negotiation process makes the case for independent testing. I think it would have been in the best interest if we would have been allowed to conduct the test ourselves, the way we wanted to, but that was not to be the case. I was not able to persuade everyone to do that 1½ years ago.

Mr. SPRATT. Could you submit for the record the program protocol or whatever you call it, that you sought, what you had to give up and what was actually enacted or taken?

Colonel BURTON. Yes, sir; I will be glad to do that.

[The following information was received for the record:]

TEST PROTOCOLS

Immediately following the approval of the Joint Live Fire Test program in March 1984, I proposed that live fire tests of the Bradley be completed that summer. I proposed 25-30 shots with Soviet RPG-7's, AT-3's and a tank fired round. All shots were to be conducted with the vehicle loaded as in combat with fuel and live ammunition on board employing random impact points around the vehicle. All shots were to be dynamic weapon impacts rather than attaching the warheads to the side of the vehicle and statically detonating them.

As a result of the negotiations with the Army, a decision was made on September 28, 1984, by USDR&E that called for ten live fire shots, with no random impact points, all controlled. No shots were aimed at internally stowed ammunition. There would be a series of building block, limited realism tests leading up to the ten live fire shots. The building block tests involved shots with only fuel on board, shots with fuel and dummy ammunition on board and off line shots into live ammunition with no fuel on board. The complex interaction between fuel and live ammunition would only occur in the final ten live fire shots. I accepted the protocol decision of the fall of 1984 as the best possible course of action that could be obtained under the circumstances.

Mr. SPRATT. I won't ask you to go through all the details now. Would it be possible for—I say this for both witnesses—to have submitted for the record the protocol or program that the Army intends to use as part of phase 2?

General THURMAN. We will be happy to do that once the Department of Defense has ruled on it. I submitted it to the Department of Defense for their approval and will, if you would permit me, let them have their cut at it.

Mr. SPRATT. OK. If we could have that for the record, I think it would be helpful for us.

[The following information was received for the record:]

BRADLEY PROTOCOL

The information was classified and provided to the committee separately.

Mr. SPRATT. Colonel Burton, in your opinion, is the enhanced protection or survivability of the Bradley that is gained by relocating the fuel and ammunition storage——

Colonel BURTON. Is it gained by that?

Mr. SPRATT. No, no, is the enhanced protection and survivability for the crew, which is gained by relocating ammunition and fuel, such that these changes ought to be retrofitted in the 3,000-odd Bradleys that have been procured to date?

Colonel BURTON. I believe that we will have concrete, firm evidence to answer that question after the phase 2 tests. That is why we have asked that that configuration be tested.

Mr. SPRATT. Is there a difference in weight between our point of view and the Army's when it comes to crew protection, the weight given to value of crew protection? Is there a debate going on here between troop expendability and material costs or mission performance?

Colonel BURTON. In my view, I believe that is correct.

Mr. SPRATT. The Army tends to give less weight. General.

General THURMAN. Would you like my view? The answer is of course we value human life and we don't agree with Colonel Burton's statement about that, and I tried to express to you that there are a variety of ways in which survivability is improved or is maintained other than armor protection. Armor protection is just one way you help survive. If the vehicle was a lead weight on the field, with a lot of armor protection, there is somebody someday who is going to invent some weapon that will get it.

Nothing is absolutely survivable. So it is a variety of things. Whether it is tactics and maneuver, or the firepower that it contains, all those things contribute in the end game to the safety of the people.

Mr. SPRATT. Let me ask you about the shots in the last tests that were fired into ammunition. There seems to be some confusion about exactly how those shots were fired or aimed or what was the nature of ammunition inside the Bradley that was the target?

GAO says shots into ammunition were excluded. Army says GAO correctly noted exclusion of certain shots, nevertheless, 6 of 10 full shots hit ammunition.

Mel Levine says no shots were directly fired and that some of the ammunition had inert fuses.

Is everybody right, somebody wrong, what is precisely the case with regard to the ammunition in these?

General THURMAN. Six of 10 shots hit ammo.

Mr. SPRATT. They happened to hit ammo, they were not directly aimed at the ammo, is that the case?

Colonel BURTON. There were no aim points which would hit the ammunition stored inside the vehicle. On two occasions, internal ammunition was accidentally struck. There was one aim point at external ammunition on the vehicle. There were only two impacts on ammunition inside.

Mr. SPRATT. The Army answer said 6 of 10 fullup shots hit ammunition.

Colonel BURTON. None of those shots were intended to hit ammunition inside the vehicle. Only two shots hit ammunition directly. Low energy spall fragments hit ammo on a few other shots, but it is misleading to count fragments as direct hits.

General THURMAN. The spall, or effects of the round did, which is one of the things you are trying to figure out, is what are the effects of the spall.

Mr. SPRATT. What was the reason for excluding directly aimed shots at the ammunition.

General THURMAN. I go back to the basic premise of how to conduct the test. It was on a chart early in—I think it was No. 7 in my briefing—it says we already know if you hit a TOW round you will have a catastrophic effect. If you hit the TOW round and have a catastrophic effect, you have lost the utility of that particular shot other than to clap yourself on the back and tell yourself that you hit a TOW round and you had a catastrophic effect. You already knew that going in.

So the impetus from our standpoint was to look at a way to add building blocks to resolve information not currently known. Now, in the cases of errors with respect to the delivery systems, which are inherent in every delivery system, we actually struck ammo

when we had not intended to do so, but the spall, in addition to all that, and the shots that in fact hit ammo, a total of those in our count is six. It is in the report. There is a shot description in the papers that we turned into the Congress that show each one of the shots and describe what it hit.

Mr. SPRATT. In effect you are saying at the outset of the test, without testing, we knew for a certainty that a direct hit on live ammunition inside the Bradley was going to create some catastrophic problems?

General THURMAN. Of certain rounds, like RPG-7's and others that are clearly overmatched to the protection of the vehicle. I will tell you categorically right now, even in March when we do our very best to up armor it, we can take a 120mm tank round and we will blow a hole in the side of the vehicle. I think even Colonel Burton would agree with that sitting at the table without ever going out and testing anything. Isn't that right?

Colonel BURTON. Yes.

General THURMAN. The analysts are in agreement. I would like the committee to recognize we got at least one agreement here today that certain rounds will in fact penetrate and blow the ammunition inside.

Mr. SPRATT. I think your predecessor put it more pithily the other day when he said you all have to pay for the tank if you fired an aim point you know is going to blow it up and it does not.

Colonel BURTON. I would like to add a point, if I may. Conventional wisdom before these tests was that if the internal ammunition is hit, it is a catastrophic event, as General Thurman just testified. But it turned out that is not always the case. On one of the occurrences when ammunition was hit inside the vehicle, it was not a catastrophic event. They don't know everything they think that they know. That is why I wanted more randomness in these tests.

Mr. SPRATT. Thank you.

Mr. STRATTON. Thank you.

If there are no more questions, the committee will go for procedural reasons, into executive session.

[Whereupon, at 4:15 p.m., the committee proceeded into executive session.]

[Executive session not printed.]

[The following questions were submitted to be answered for the record:]

BRADLEY FIGHTING VEHICLE ALTERNATIVES

Mr. STRATTON. General, in your view, what are the possible alternatives to the Bradley Fighting Vehicle? Have you examined all of the alternatives? Please tell us what are the strengths and weaknesses of these alternatives.

General THURMAN. The logically possible alternatives to the Bradley both in the past and now are many. At numerous different times during the development of the Bradley, we have analyzed may alternative vehicles, never prematurely ruling out alternatives.

In 1976, the Larkin Task Force looked at not only various versions of the Mechanized Infantry Combat Vehicle (MICV) with one and two man turret and with and without TOW but also at the BMP, the basic M113 and a stretched M113 with a turret. During the 1977 Cost and Operational Effectiveness Analysis (COEA) we looked at the MICV and M113 again as well as the Dutch AIFV and an M113/ITV mix of vehicles. Again in 1978, the Crizer Task force looked at the alternatives in-

cluding vehicles weighing as much as 55–69 tons. Also in 1978, the Mahafey Special Study Group looked at numerous alternatives including a special armored cavalry combat vehicle. Again in 1979 during the IFV/CFV COEA update, we reviewed the bidding on alternatives.

In all of these reviews, the Bradley consistently came up the winner. Alternatives were either deficient in terms of the multiple capabilities we needed in a fighting vehicle, not feasible at the time, overly expensive in terms of the dollars and time associated with the research, development, testing and production cycle, constituted pushing the potential of the venerable M113 design too far or, in the case of M113/ITV vehicle mixes, complicated command and control and required additional personnel.

At your request, we have recently undertaken additional wargaming and cost analysis of 7 alternatives including variations on the M113 made possible by new technologies and an M113/ITV mix to see if the Bradley is still the best solution. While the analysis is not yet complete, emerging results indicate that regression to the M113 would be a mistake, increasing the need for additional personnel, increasing the overall life cycle cost of the systems and decreasing combat effectiveness. It also seems clear that enhancing the survivability of the Bradley using new technology may be a smart move, though this must first be confirmed by the March/April 1986 tests we will run. The Bradley appears to offer the best combination of firepower, mobility and overall contribution to the combined arms team at the same or lower personnel cost than alternatives and with equal or better command and control than alternatives.

The comparative analysis is not available at this time. It will be provided by 20 March, 1986 in a separate report titled, "Bradley Fighting Vehicle Capability Analysis."

Mr. STRATTON. General Thurman, what would be the expected relative vulnerability of the M113 and Bradley under battlefield conditions, neglecting mobility differences as determined by the Army's computer survivability analyses?

General THURMAN. A report, "Bradley Fighting Vehicle Capability Analysis", which is classified, has been provided to the committee.

## ARMOR TECHNOLOGY

Mr. STRATTON. In the 1978 hearings, the Army argued that any additional protection from special armor on the Bradley would add considerable weight and cost to the vehicle. How has technology for armor changed in the last eight years. How much additional weight and cost per vehicle are you considering?

General THURMAN. The Bradley as currently configured can survive on the battlefield using current doctrine. The changes being considered are a result of a new achievement in armor technology that improved the protection level. An additional weight of 7000 pounds will significantly improve the protection level of Bradley without degrading it's performance level. Costs are estimated at less than 5% of the vehicle cost. These changes, however, will be implemented only if they are cost effective and produce war fighting advantage.

## AIR FORCE AND NAVY MUNITIONS

Mr. STRATTON. General, I understand that the Air Force and the Navy are investigating plastic-bonded explosives or High Explosives Insensitive to reduce the sensitivity chain-reactions of their munitions when stored. Is the Army exploring these concepts? What is your assessment? Should this be used in conjunction with restowage of ammunition?

General THURMAN. Yes, the Army is exploring these concepts for the 25mm ammunition and the TOW 2 missile. A research and development (R&D) program is being accelerated to incorporate Low Vulnerability Ammunition (LOVA) propellant in the 25mm. LOVA is insensitive to spall. For the TOW 2B Missile there is a plan to replace the current sustaining rocket motor propellant with a less sensitive smokeless propellant. The Army is planning to accelerate munitions stowed in the BFV within the next three years.

## BFV AND M113 MIX IN HEAVY DIVISIONS

Mr. STRATTON. How did the Army arrive at the currently planned mix of Bradleys and M113s in the heavy divisions and have you looked at differing combinations to include a replacement of some Bradleys with one M113 and ITV each, thus resulting in a higher number of total vehicles?

General THURMAN. The Army arrived at the currently planned mix of Bradleys and M113's in the heavy division as a result of comprehensive studies and the force design process which became known as Army 86. The Army 86 process was begun in the early 1970's by the U.S. Army Training and Doctrine Command under the command of General DePuy. The process was aimed at transitioning the Army through a period of equipment modernization greater than any since the mobilization for World War II.

First among the series of Army 86 studies was that which determined how heavy divisions should be organized to capitalize on the Army's modernization effort. This specific study became known as Division 86 and evolved from several field studies and general officer workshops over the span of several years—the Division Restructuring Study, the Division Restructuring Evaluation, and the Battlefield Development Plan. A brief description of each is necessary to understand its contribution to the Division 86 or heavy division methodology.

The Division Restructuring Study (DRS), initiated in May 1976, identified for testing a new heavy division organization and concepts of operation. The tested unit was to be a clear alternative to a more gradual evolution of then current organization.

A Division Restructuring Evaluation (DRE) was initiated in February 1977 to evaluate selected DRS restructured organizations and concepts. DRE was also tasked to develop recommendations concerning the operational concepts and organizational structures the Army's heavy division required to best perform its mission in 1986. Through these early studies it was apparent that both the then current (H—series) and the restructured (T—transitional test series) organizations enjoyed features which should be incorporated into the Army's heavy division for the 1980's (J—series organization).

The third major preliminary study input to Division 86 was the Battlefield Development Plan (BDP). BDP 1, published in November 1978, was intended as a roadmap for the future. It concluded with priorities and issues which required the Army's attention.

BDP 1 was developed based on an assessment of the Army's selected near-term force readiness and mid-range force modernization programs. It set forth requirements necessary for program improvement. An assessment of U.S. and Soviet combat readiness, force modernization, personnel, weapon systems, force mixes, technology, training, and production capabilities was included. The effects of technology on the Army in the 1980's were also described, as were anticipated problems in training, personnel acquisition, and with spiraling costs. In BDP 1 combat was analyzed in terms of specific battlefield functions: target servicing, counterfire, air defense, logistical support, surveillance/fusion, interdiction, force mobility, reconstitution, and command, control and communications. Using this functional approach, BDP 1 presented a battlefield analysis which assessed deficiencies, then made recommendations to correct those deficiencies.

General officer workshop played a key role in the total review process. Four were phased throughout the study period to develop interim guidance and direction. The first workshop, held in late 1978, oriented on operational concepts, constraints and study plans. The second reviewed emerging results of force structure trade-off analyses and served to reduce the number of alternatives. Another, held at about midpoint in the effort, approved the objective division. The final workshop, held in the fall of 1980, put the finishing touches on the Division 86 structure before approval by the Chief of Staff of the Army.

Tank battalions and mechanized infantry battalions constitute the cutting edge of the heavy division. Several organizational concepts were used to design the Division 86 maneuver battalions. Greater emphasis was placed on smaller tactical formations; at the platoon and company level, the tank platoon consists of four tanks instead of the previous five tanks. The company with three tank platoons therefore, has 14 tanks (two in the company headquarters) instead of the previous 17. Bradley infantry companies consist of 13 Bradleys: three platoons of four and one for the company commander.

Tests show greater tactical effectiveness for a force of smaller platoons compared to an equal size force of larger platoons.

Another idea that guided the design of the maneuver battalions was that companies should have only one major weapons system. This simplifies the tactical and technical knowledge needed by the company commander. The mechanized infantry company commander, therefore, no longer has mortars and anti-tank weapons that were organic to his company. All of the Improved TOW Vehicles (ITV's) are organized into anti-tank companies of 12 systems. One of these companies is found in each mechanized infantry battalion. An ITV anti-tank company was not added to

the tank battalion because of space constraints. The Army, because of the tank company's greater offensive maneuver capability, also rejected any option which traded off a tank company for an ITV company.

Still another factor that influenced maneuver battalion design was the idea that the headquarters of the tank and mechanized battalions should be similar. Since an infantry company would be frequently attached to a tank battalion and a tank company would be attached to an infantry battalion, the basic battalion structures should have similar supply and recovery capabilities. The structure of the headquarters company would allow for the line companies to be single weapons system organizations, reducing complexity and improving logistics.

Both the tank and infantry battalions would have four maneuver companies instead of three. There were essentially two reasons for this. Organizing the smaller companies into four-company battalions reduced the number of battalions needed in the division to produce the same combat power in terms of tanks and infantry on the ground. This reduction in overhead made limited numbers of force structure spaces available for transfer to other parts of the division. Also, the four-company battalion offered the battalion commander greater flexibility, particularly in offensive operations. By retaining one or two uncommitted companies, the battalion commander would be able to maintain an attack's momentum by passing fresh units through or around those that had taken losses or become bogged down.

The combat vehicles that enhance the capability of the Division 86 maneuver units are the M1 Abrams tank and the M2 Bradley Infantry Fighting Vehicle/M3 Cavalry Fighting Vehicle. In the heavy division, the single weapons system companies are either pure M1 tank or M2 fighting vehicle companies. All scout platoons were organized the same, consisting of six M3 Cavalry fighting vehicles. The M113 family of vehicles was retained for uses which did not require the fighting capability of the M1 or M2/3 families of vehicles. Instead, M113's are used as mortar carriers, forward maintenance tracks, forward artillery observer tracks, medic tracks and for other general purpose lightly armored track vehicle requirements. M113's belong to the Headquarters Company, the ITV company or to attached combat support elements.

Information on alternative combinations of M113's and ITV's is the same as that just provided above.

### BRADLEY VERSUS M113 EMPLOYMENT

Mr. STRATTON. How will the Bradley be employed differently than the M113 and why would the M113, possibly equipped with a 25mm cannon, in combination with the ITV, be less capable of performing this mission?

General THURMAN. The tactical employment of the Bradley differs from that of its predecessor, the M113, because its capabilities are so much greater.

In firepower, the Bradley can outrange threat tank cannons and kill tanks with its TOW out to 3,750 meters. The M113 can at best kill a tank at 1,000 meters with its squad's DRAGON. The Bradley squad also has this DRAGON capability. The Bradley 25mm gun can kill BMPs and other lightly armored vehicles at extended ranges as well as troops at even greater ranges with its two types of ammunition. The M113 with its 50 caliber machine gun is no match in this respect. The Bradley's coaxial 7.62mm machine gun can kill and suppress troops and thin skinned vehicles. The M113 has no coax. The Bradley's firing port weapons provide close-in protective fires without exposing soldiers. The M113 lacks this feature. Finally, on the firepower differential, the Bradley, unlike the M113, can do all of the foregoing not only during the day but also at night and during limited visibility thanks to its thermal sight. The Bradley can also fire its 25mm gun and coax effectively on the move because these weapons are stabilized, unliked those of the M113.

The greatly increased variety, range and lethality of Bradley firepower enables it to provide far more effective overwatch to tanks, other Bradleys or dismounted infantry and to provide fire support while moving. This enables us to bound farther during movement, to position our forces with greater dispersion and depth without loss of mutual support between positions and to expand the effective area in which dismounted infantry and vehicles can fight effectively in relation to each other in positions that are optimal for each. Tanks do not have to be diverted unnecessarily to providing overwatch and otherwise fixing threat forces because the Bradley can perform these functions while the M113 cannot. This frees tanks to do what they do best: maneuver. All of this can be done under nearly all conditions of visibility which is is not true of the M113.

Unlike the M113, the Bradley's cross country tactical mobility and agility is a match for that of the M-1 tank. It can keep pace with the tank without slowing it

down as does the M113 if the mixed force attempts to maintain the integrity of its unit. The Bradley can thus effectively escort tanks at speed protecting their flanks and rear with stabilized weapons. This level of protection cannot be afforded maneuvering tanks by the M113 and tanks are thus compromised.

The increased level of protection against small arms, automatic weapons and artillery provided by the Bradley as compared to the M113, enables infantrymen to survive better on the lethal modern battlefield.

Comparative analysis is underway of the Bradley in its current configuration and in possible future improved form and various M113 and M113/ITV mixes, some of which also include 25mm and other firepower, optics and protection improvements already on the current Bradley as well as possible protection enhancements that may be made to any lightly armored vehicle as a result of recent technological developments.

The results of this analysis will be provided by 20 March 1986 in the separate report, "Bradley Fighting Vehicle Capability Analysis".

#### BRADLEY RETROFITTING OF SURVIVABILITY MODIFICATION

Mr. SPRATT. Please provide the Army's current plan for retrofitting the survivability modifications to the Bradley. How will these retrofits be done? Where will these be done?

General THURMAN. We have not yet decided whether or not to retrofit vehicles already produced with the survivability improvements. The vehicles currently being procured are excellent, robust fully mission capable vehicles. Once we finish testing this summer, we will decide upon the configuration which promises the most cost (and battle) effective improvements. These will be cut into production, beginning in FY 87. If we retrofit, it will probably be an Army depot job. We usually use Mainz depot in Germany and Red River depot in the United States for jobs like this.

#### AC AND RC RETROFIT PLAN

Mr. SPRATT. Please provide a breakout by unit (Active and Reserve) of the retrofit plan (by year). Provide the deployment dates.

General THURMAN. The only plan now in place involving retrofit to Bradley is the one for the TOW 2. The first 355 M2A1/M3A1s coming off the production line will not include the TOW 2 subsystem which is one of the Block I modifications. The reasons for this delay were explained in earlier testimony. Current plans call for these vehicles to be retrofitted with TOW 2 as follows: [deleted] 122 vehicles, June–September 1989; [deleted] 160 vehicles, June 1991–February 1992. Additionally, 73 other vehicles in various organizations in CONUS and OCONUS will be retrofitted during CYs 1990, 1991 and early 1992. After Phase II testing, a determination will be made regarding production line cut in and retrofitting of survivability enhancements.

#### BRADLEY FIGHTING VEHICLES IN URBAN AREAS

Mrs. BYRON. One of the assets of the Bradley made known by the Army is its ability to utilize rugged terrain so that very little of the vehicle is exposed when firing from a defensive position. However, how useful will this asset be when fighting is contained to urbanized areas such as those found in Western Europe?

General THURMAN. Military operations in urban terrain are the same as other operations: they are just conducted on a different piece of terrain. The urban area presents special problems: close quarters, restricted maneuver room, three dimensional environment. Since the Bradley is not a tank, its infantry will fight dismounted in an urban area just as its infantry would fight in many other situations. BFV's follow and are brought up to secured locations to provide direct-fire support. In defensive operations, as in the offense, the infantry fight dismounted. Here the BFV's superior mobility and agility will dominate streets and other high speed avenues of approach, using their 25mm guns and TOW's to stop enemy armored vehicles when required.

Certain features of the Bradley make it a very potent support weapon for dismounted infantry in urban areas. The 25mm gun, with its added power and stabilized accuracy compared to the 50 cal. machine gun is very effective in its direct fire support role. Its near vertical elevation capability provides excellent direct fire for engaging targets in buildings above moving tanks. The TOW system, besides its antitank role, could be used against a fortified position in a building. Besides its nearly 100% probability of a direct hit, the rubble producing effect of the blast would be confined inside the buildings thereby not adding to the rubble outside (an

important factor in urban combat success). The Bradley's maneuverability, its ability to "turn on a dime", would be of great advantage in the rubble clogged, blocked streets of the urban environment. Finally, if required and to protect gunner, driver and vehicle commander, the Bradley provides effective protection from approximately 85–90% of the weapons a Soviet infantry or motorized rifle regiment could use against the soldiers.

As to the Bradley's utilization of rugged terrain to conceal itself, this ability is as important if not more so in urban terrain. Because of its elevated sights and its elevated TOW position, the BFV can utilize walls, rubble piles, corners and certain slope conditions in town to conceal itself, providing direct fire support to the dismounted infantry, and protecting the associated tanks. These same features, together with the street system, offer obstacles that canalize mechanized forces.

#### BRADLEY SECOND SOURCE

Mrs. BYRON. The Bradley is a mature program judging from the amount already delivered to the Army. Why hasn't the Army second sourced this vehicle at both the prime contractor and the subcontractor level? Does the Army ever intend to second source the Bradley?

General THURMAN. No, we have determined that second sourcing of vehicle assembly would not be cost effective. We are actively working on second sourcing at the sub-contractor level, e.g., TOW subsystem, turret drives, and transmissions.

#### BRADLEY ALUMINUM HULL

Mrs. BYRON. What was the rationale behind using an aluminum hull? Could you provide the subcommittee with information on weight variance between the existing hull and one that would be made with steel? Is there another alloy which could better withstand enemy impact and still be cost-effective?

General THURMAN. Aluminum armor for the Bradley resulted from a careful design trade-off of all vehicle requirements. From an armor standpoint, aluminum provides better protection from fragmentation munitions and small arms at a 20% weight saving than the equivalent protection of steel armor. The lethality effects of threat munitions which penetrates into the troop compartment are independent of the armor material due to spall, jet, and explosion effects which far outweight any additional effects based solely upon the choice of aluminum versus steel armor. There is not another alloy which will withstand enemy impacts and is cost-effective.

#### BRADLEY APPLIQUE

Mrs. BYRON. It is my understanding that the Army intends to encase the Bradley with a tougher applique to lessen the impact of anti-tank fire. Will the Army or the contractor retrofit existing vehicles? How much will the retrofitting cost?

General THURMAN. We have not yet decided whether or not to retrofit vehicles already produced which do not have survivability improvements. We know that the vehicles currently being produced are fully combat capable vehicles. Once we finish testing this summer, we will decide upon a configuration which promises the most cost and battle effective improvements. These we will cut into production beginning in FY87. At that time we will also consider the option of a fleet retrofit, which will be considerably more costly than a product improvement added to the production line. Depending upon employment scenario, and projected benefits, we may decide to retrofit all, part, or none of the current fleet. If we do retrofit, it will probably be an Army depot job. The cost of a retrofit is not known now.

#### RETROFITTING TRADEOFFS

Mrs. BYRON. What type of trade offs do you expect we will encounter concerning the retrofitting of the Bradley? Decreased mobility? Obstruction of the portholes?

General THURMAN. The Bradley as currently configured can survive on the battlefield using current doctrine. The changes being considered are results of new achievements in armor technology that can improve the protection levels. There are trade offs. The armor will add weight, but by changing final drives to the ones we use for MLRS, we can retain mobility and increase protection. The final designs for the armor and spall liner may cover the lateral firing ports. This will be a trade off decision, in that the protection provided by the improved armor provides greater advantage than alteral suppresion from the firing ports. Costs for all changes are esimated at less than 5% of vehicle cost. These changes, however, will be implemented only if they are cost effective and produce real war fighting advantages.

CHANGE ORDERS

Mrs. BYRON. How many change orders have been made to the Bradley over the last five years and what have these change orders covered and at what cost?

General THURMAN. During the period 1980–1984, there have been 7521 engineering change orders (ECO's) and engineering change notices (ECNs). Over 80% of the changes were initiated by the contractor (in 1981 and 1982) at no cost to the government under the system responsibility clause in the production contract. This high number of changes occurred during the first two years of production. Since 1982, the average number of changes has declined to approximately 500 per year. We anticipate a higher than normal number of changes during the 1985 funded delivery period (May 1986–April 1987) due to the introduction of an A1 model. The change orders and change notices have covered all major components of Bradley including: chassis, turret, engine, transmission, turret drive system, fire control system and 25mm gun. Cost for the years 1980 through 1984 is $36.1 million.

BURTON REPORT ON CASUALTY ASSESSMENT

Mrs. BYRON. What was the rationale behind classifying the portions of the Burton report which deal with casualty assessment associated with a direct hit on the Bradley by enemy fire?

General THURMAN. That was totally an OSD responsibility. Col. Burton should have had control of that action himself. The classifying of his report would follow the guidelines given by DOD regulations that we all use.

BRADLEY FIGHTING VEHICLE

Mr. STRATTON. As a tester, what would be required to provide the basis for conclusions regarding system's overall survivability in a likely combat environment?

Answer. There are two aspects to overall survivability in a likely combat environment: the probability of being hit and the vulnerability of the vehicle once it is hit. Phase I clearly documented the vulnerabiities given a hit and pointed the way to improvements and modifications which will reduce casualties once a hit has occurred.

Phase I results also gave some insights into overall survivability since the primary hazard to the crew and vehicle was identified as the large amounts of internally stowed ammunition. Because of the relatively large ammunition area presented to attackers, we can expect significant hits on ammunition and therefore high casualties. However, final overall survivability conclusions should include test-based estimates of the probability of Bradley being hit in a realistic combat environment.

Mr. STRATTON. As a tester and an analyst, what conclusions can we reasonably draw from the ten live-fire shots done on the Bradley?

Answer. The most important conclusions are:

Ammunition stored in the troop compartment is the major cause of unnecessary casualties. When this ammunition is hit, Bradley casualties increase by factors of two to three. The same can be said for the Soviet BMP and the U.S. ITV.

Fuel fire extinguishers in the troop compartment may force the troops out of the vehicle almost every time it is hit, thereby causing greater risk of added casualties. The atmosphere inside the vehicle after a hit is simply intolerable.

Bradley casualties can be significantly reduced. Moving ammunition, fuel and extinguishers out of the troop compartment would provide the greatest combat casualty reductions.

Mr. STRATTON. As a tester, would it be appropriate to draw conclusions regarding the overall operational survivability of a system like the Bradley based on the tests done to date?

Answer. Yes, some conclusions can be drawn on the overall operational survivability of the Bradley based upon the tests done to date. As already indicated, the internally stowed ammunition represents the greatest hazard to the crew. When that ammunition is hit, casualties increase by factors of two to three. Actual presented areas for ammunition vary markedly among vehicles. The Bradley's ammunition presents about three times as much area to hits as does the BMP's ammunition. Thus in combat, greater total casualties can be expected. Additionally, it is appropriate to conclude that the troops will be driven out of the vehicle by the contaminated atmosphere inside following a hit. This has serious consequences in terms of possibly more casualties and whether or not the vehicle can continue to fight if the troops have evacuated.

Mr. STRATTON. The FY86 DoD Authorization Act requires the phase II test results to be reported to Congress by June 1986. In light of all that is required for the phase

II test of survivability enhancements, is the June 1986 reporting date a reasonable deadline?

If not, what are the obstacles? And, what would you consider reasonable?

Answer. A very large, ambitious and important Phase II test program has been planned involving over 50 shots during March and April. The Army has recently agreed to include in Phase II testing, in addition to the modification packages they originally had in mind, a Bradley configured with all fuel and ammunition removed from the troop compartment and stowed either externally or in externally vented compartments. A prototype is under construction and will be available for tests approximately May 1. The tests should be completed by mid-May. In order to include test results from this configuration it may be necessary to delay the Phase II report to Congress from June 1 to July 1. It is extremely important that results from this configuration be included in the Phase II report.

# BRIEFING FOLLOWED BY HEARING ON FISCAL YEAR 1987 DEPARTMENT OF DEFENSE AUTHORIZATION REQUEST

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HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
PROCUREMENT AND MILITARY
NUCLEAR SYSTEMS SUBCOMMITTEE,
*Washington, DC, Monday, February 24, 1986.*

The subcommittee met, pursuant to notice, at 10 a.m., in room 2118, Rayburn House Office Building, Hon. Samuel S. Stratton (chairman of the subcommittee) presiding.

## STATEMENT OF HON. SAMUEL S. STRATTON, A REPRESENTATIVE FROM NEW YORK, CHAIRMAN, PROCUREMENT AND MILITARY NUCLEAR SYSTEMS SUBCOMMITTEE

Mr. STRATTON. The subcommittee will come to order.

This morning the subcommittee will receive testimony on the impact of the Gramm-Rudman deficit reduction law on defense procurement.

Our principal witness is Assistant Secretary of Defense Robert W. Helm, who is the Comptroller of the DOD. He is joined by military service representatives.

The purpose of this hearing is to review the impact of Gramm-Rudman on defense procurement and to examine the DOD's approach to the fiscal year 1987 sequestration process imposed by the new antideficit law. As members recall, the defense share for fiscal year 1986 is $5.9 billion, exactly one-half of the total $11.7 billion reduction called for in Gramm-Rudman.

Essentially, the DOD applied a standard 4.9-percent reduction across the board to reach the deficit reduction target. This action resulted in a reduction of some $6.6 billion in budget authority and about $900 million in outlays for defense procurement in fiscal year 1986. Prior year reductions brought the total cut to $6.9 billion in budget authority.

Several programs and contracts were exempt from the process, however. We need to understand the policy considerations and priorities that the Department assigned to these various activities. Also, the subcommittee needs to have the benefit of the Department's thinking about how this issue should be considered in fiscal year 1987.

For example, a number of new multiyear contracts are proposed in fiscal year 1987. Under Gramm-Rudman, it is difficult to understand how the Congress could authorize such contracts. One of the criteria of multiyear contracting is stable funding. With Gramm-Rudman, instability seems to be the rule rather than the exception.

Also, it appears that the Congress may be faced with making some significant cuts in defense spending to meet the deficit target of $144 billion for fiscal year 1987. If that proves to be the case, it would be helpful to have the Department's views on how we should accomplish this task. For example, would it be preferable to place greater emphasis on terminating programs or on salami slicing them. This dichomatic course of action will produce even greater production inefficiencies and increased costs.

I would like also to have Secretary Helm enlighten us on some comments that appeared in the press a week or so ago where the Secretary of Defense indicated that there were certain categories of weapons and certain categories of defense items that had greater priority in his mind than others, and I think this perhaps is an area that we should be filled in on. It might be helpful to be sure we understand exactly what the Secretary has in mind.

Before calling on Secretary Helm, I would like to recognize Representative Marjorie Holt, our ranking Republican, for her opening statement.

## STATEMENT OF HON. MARJORIE S. HOLT, A REPRESENTATIVE FROM MARYLAND, RANKING MINORITY MEMBER, PROCUREMENT AND MILITARY NUCLEAR SYSTEMS SUBCOMMITTEE

Mrs. HOLT. Thank you, Mr. Chairman, and welcome.

I am pleased that our first subcommittee hearing will address the new antideficit law, and the Gramm-Rudman-Hollings reductions. I am concerned that we do not fully understand the broad economic implications of this legislation. As such, I am hopeful that our witnesses will be able to provide some insights for us today.

Thank you, Mr. Chairman. I look forward to hearing the testimony.

Mr. STRATTON. Thank you.

Mr. Secretary, you may proceed.

## STATEMENT OF HON. ROBERT W. HELM, ASSISTANT SECRETARY OF DEFENSE, COMPTROLLER

Mr. HELM. Thank you, Mr. Chairman. Good morning to you and the other members of the committee.

The subcommittee has requested that the Department provide a summary of how the requirements of the 1986 Gramm-Rudman Act provisions were carried out by the Department. I have provided a written statement which I will submit for the record, but I would like to briefly summarize it and in the process perhaps answer some of the questions the members have in advance.

The DOD, like all other agencies of the Government, watched the Gramm-Rudman legislation develop in Congress and struggled, as did everyone else to fully comprehend its requirements and to respond to them in the most straightforward manner possible.

Essentially the DOD implemented the 1986 Gramm-Rudman sequestration planning requirements between December 25 and January 1, so there was a rather limited timeframe for the Department to act within. Throughout, as I said, we sought to apply the most straightforward and least complicated interpretation of the

language and to abide by congressional intent at the same time. There were moments when this was not the easiest thing to do, given the aspects of the total Gramm-Rudman language.

The procedures that we followed, as I said, were as straightforward as we could make them. Just to refresh the committee members, under the terms of Gramm-Rudman the DOD function 050 was required to provide half of the $11.7 billion outlay reduction that was required for fiscal year 1986. For the functions this meant about $5.85 billion in outlays were to come from function 050, which included DOD and nuclear weapon activities of the Department of Energy.

Of that $5.85 billion, the DOD was responsible for $5.1 billion in outlays. The base for calculating this reduction was the new budget authority that was proposed in fiscal year 1986 for the Department, plus unobligated balances still remaining from prior year appropriations. The outlays were calculated from this budget authority base and the other provisions of the legislation were then applied to that base.

I should point out that in the base we were required to leave out about $2.2 billion which were associated with the so-called appropriated, not authorized issue bound up in the 1986 appropriations bill. The Department and the administration concluded, with the concurrence of CBO, to leave out the $6.3 billion in transfers from prior year, which was an issue of some contention during the debate on the continuing resolution.

The language in the CRA said that that $6.3 billion was not to be used to offset the impact of the Gramm-Rudman sequestration. We interpreted that to mean that it should not play a part in the sequestration and consequently it was left out of the base.

Subsequently, the General Accounting Office, in reviewing the sequestration plan, determined that that money should be added back in and sequestration was applied to it later on.

In fiscal year 1986 DOD did have flexibility it could apply in exempting areas of the budget from sequestration. Specifically the military personnel accounts could be exempted in part or in total, but that action would amount to reducing the base for sequestering and therefore it would require the rest of the defense budget to bear a larger percentage reduction to ensure realizing the $5.1 billion in outlay savings.

Additionally, specific program projects and activities could be exempted if a need was determined, but other program projects or activities in the same appropriation account had to make up the difference up to a limit of twice the standard percentage reduction which was required for each PPA.

There were also a number of restrictions placed on the Department in implementing Gramm-Rudman. Specifically there could be no termination of a program as a result of sequestration of specific contracts. However, a program could be terminated if legal obligations were not violated and if it did not result in a net loss in the year that was at issue.

Additionally base closures or realignments could not be used to achieve the sequestering amounts. However, bases per se were not programs, projects, and activities in themselves, so this restriction did not bear that much upon our actions.

In addition, programs which had been increased by Congress by 10 percent or more could not be reduced by more than the standard percentage. Essentially, after taking these flexibilities into account, and implementing them, it was determined that the $5.4 billion outlay target represented approximately a 4.9 percent reduction in each program, project, and activity from the outlay base.

The definition of program, project, and activity that we used was the one provided by Congress in the continuing resolution. Specifically PPA was defined to be the budget activity for military personnel and O&M and the P-1/R-1/C-1 line-item programs for procurement research and development and military construction. So essentially each line-item program, was a PPA, each military construction project, each building, each individual activity was also a PPA that was subject to the 4.9-percent reduction.

In terms of the implementation of the flexibilities that were available to the Department, virtually all of the military personnel account was exempted from the provisions of sequestering for fiscal year 1986, the principal goal being to protect the great gains we had made over the last 5 years in terms of the quality and retention of our personnel and the high morale. It would be undesirable to expose the military personnel accounts to sequestering in the full amount of 4.9 percent which would have required a $2 billion reduction be taken for military personnel. That sort of exemption would have required about a 280,000 personnel reduction to be implemented by the Department.

There were three areas of the military personnel accounts which were not exempted from sequester. Specifically these areas were permanent change of station, early release of separating personnel, and slowing somewhat the growth of training and schooling for Reserve personnel.

These reductions were considered to have no adverse effect on military personnel or were responsive to congressional interest in holding down costs, specifically in the area of permanent change of station.

Additionally, the President directed that the Strategic Defense Initiative, his highest priority program, should be exempted from the sequestering. Approximately $1 billion had been reduced from his fiscal year 1986 request, almost a 25-percent reduction, whereas the rest of the strategic program had been treated more generously by Congress in consonance with the President's request.

Finally, the services and the OSD staff were asked to identify additional candidate PPA's for exemption. They were advised to guard against undue impact on Presidential programs. Specifically they were directed to protect program execution. Programs in being——

Mr. Stratton. Let me interrupt. I am not sure that I understand what you are saying. My understanding is that the first step in Gramm-Rudman is for Congress to make a reduction in the budget of $36 billion and only in the event that the Congress fails to make that reduction does the President's authority come in and sequester kick-in, and we haven't had any vote in the House on $36 billion, and you are listing what the President is going to do and what he is not going to do, and I don't quite follow where that comes in.

Mr. HELM. Mr. Chairman, I am describing the steps that were taken to implement the provisions of Gramm-Rudman as related to fiscal year 1986 in light of the CRA, which was passed several months ago by Congress. We haven't gotten to fiscal year 1987 yet. There are no bases for sequestration in the context of fiscal year 1987, but these sequestrations for fiscal year 1986 go into effect on March 1 and become legally required. That was a specific provision of Gramm-Rudman legislation to reduce outlays in national security by—total Government outlays by $11.7 billion and $5.8 billion had to come from the national defense function, $5.1——

Mr. STRATTON. In 1986?

Mr. HELM. From fiscal year 1986. What I am outlining here is the procedure we used in meeting our obligation for fiscal year 1986 as part of the administration's overall responsibility. So this totally deals with fiscal year 1986.

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Mrs. HOLT. We haven't all agreed on that yet.

Mr. STRATTON. Am I correct that since 1986 is an anomaly, when we come to 1987, the Congress will be required to make a cut of a certain amount—hopefully $36 billion—and in the event that that is not done, then the President would sequester; is that correct?

Mr. HELM. That is right. In the event that the result of the authorization and appropriation process for fiscal year 1987 yields a deficit higher than $144 billion, the amount that it exceeded that level would be determined by the Director of OMB and Director of the Congressional Budget Office jointly. The procedure that is followed after that is somewhat in doubt right now as a result of the three-judge court decision, which, at the moment at least, has put the General Accounting Office's role in Gramm-Rudman somewhat in doubt. But in any event, either GAO or the Congress would be required to trigger the Gramm-Rudman sequestration process for 1987 if it is indeed necessary. It is not clear yet that it will be necessary.

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Mr. HELM. Yes, he does. In the case of defense, in fiscal year 1986, we had some flexibilities. Those flexibilities do not or will not exist in fiscal year 1987 and sequestration will be a very dull, very mechanical calculational procedure. Someone with a hand calculator can manage sequestering very well for the entire DOD, since there are no flexibilities whatsoever.

In 1986 we did have some latitude in the area of military personnel to exempt certain programs that we felt couldn't absorb the impact of this 5 percent reduction. We also focused on efficient contracts, multiyear contracts, or firm fixed price contracts the Department had negotiated. These contracts contain some advantageous cost provisions. That flexibility will not exist in fiscal year 1987 if sequestering is triggered and it is hoped devoutly by anyone

In addition, programs which had been increased by Congress by 10 percent or more could not be reduced by more than the standard percentage. Essentially, after taking these flexibilities into account, and implementing them, it was determined that the $5.4 billion outlay target represented approximately a 4.9 percent reduction in each program, project, and activity from the outlay base.

The definition of program, project, and activity that we used was the one provided by Congress in the continuing resolution. Specifically PPA was defined to be the budget activity for military personnel and O&M and the P-1/R-1/C-1 line-item programs for procurement research and development and military construction. So essentially each line-item program, was a PPA, each military construction project, each building, each individual activity was also a PPA that was subject to the 4.9-percent reduction.

In terms of the implementation of the flexibilities that were available to the Department, virtually all of the military personnel account was exempted from the provisions of sequestering for fiscal year 1986, the principal goal being to protect the great gains we had made over the last 5 years in terms of the quality and retention of our personnel and the high morale. It would be undesirable to expose the military personnel accounts to sequestering in the full amount of 4.9 percent which would have required a $2 billion reduction be taken for military personnel. That sort of exemption would have required about a 280,000 personnel reduction to be implemented by the Department.

There were three areas of the military personnel accounts which were not exempted from sequester. Specifically these areas were permanent change of station, early release of separating personnel, and slowing somewhat the growth of training and schooling for Reserve personnel.

These reductions were considered to have no adverse effect on military personnel or were responsive to congressional interest in holding down costs, specifically in the area of permanent change of station.

Additionally, the President directed that the Strategic Defense Initiative, his highest priority program, should be exempted from the sequestering. Approximately $1 billion had been reduced from his fiscal year 1986 request, almost a 25-percent reduction, whereas the rest of the strategic program had been treated more generously by Congress in consonance with the President's request.

Finally, the services and the OSD staff were asked to identify additional candidate PPA's for exemption. They were advised to guard against undue impact on Presidential programs. Specifically they were directed to protect program execution. Programs in being——

Mr. STRATTON. Let me interrupt. I am not sure that I understand what you are saying. My understanding is that the first step in Gramm-Rudman is for Congress to make a reduction in the budget of $36 billion and only in the event that the Congress fails to make that reduction does the President's authority come in and sequester kick-in, and we haven't had any vote in the House on $36 billion, and you are listing what the President is going to do and what he is not going to do, and I don't quite follow where that comes in.

Mr. HELM. Mr. Chairman, I am describing the steps that were taken to implement the provisions of Gramm-Rudman as related to fiscal year 1986 in light of the CRA, which was passed several months ago by Congress. We haven't gotten to fiscal year 1987 yet. There are no bases for sequestration in the context of fiscal year 1987, but these sequestrations for fiscal year 1986 go into effect on March 1 and become legally required. That was a specific provision of Gramm-Rudman legislation to reduce outlays in national security by—total Government outlays by $11.7 billion and $5.8 billion had to come from the national defense function, $5.1——

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involved in the fiscal management of the DOD that sequestering does not occur in fiscal year 1987 because it would be a very disruptive procedure. It is impossible right now to calculate the magnitude because one doesn't know what the deficit is actually going to be for fiscal year 1987. Once we do know what the deficit is then, as I said, it is a very straightforward procedure to calculate the percentage by which each program, project, and activity is to be reduced.

Mr. STRATTON. OK, thank you. I didn't want to interrupt but this is a little hard for us to figure out.

Mr. HELM. Well, it was also very difficult for the Department to follow the development of the language during the conference deliberations on Gramm-Rudman and I think it is fair to say the whole administration went through a learning procedure as it tried to deal with the complexities of this legislation. What I have been doing up to now, Mr. Chairman, is describing how it operated in 1986, if I could just conclude very quickly.

As I said, the President did ask the services and OSD for a list of programs which should be exempted on the basis of the adverse effects that sequesters would have on program execution and to specifically protect contract efficiencies. At the same time, there was a requirement that any program exempted had to be accounted for somewhere else in the same appropriation account. So the piper did have to be paid, Mr. Chairman, and the services were also asked to provide a list of programs which could provide funds to offset programs which were protected.

We did encourage the services to think carefully about entering into wholesale exemptions of programs because these offsets would have to be found and it would have been very disruptive to manage reshuffling the entire 1986 Defense Program by exempting large numbers of programs and having to reduce others by 4.9 percent or up to 9.8 percent in the case of taking twice the available percentage.

Service candidates were reviewed by OSD and the Secretary finally determined that the exemptions would be limited to those multiyear and firm fixed price contracts which did not have sufficient reserves to absorb the 4.9-percent reduction. We felt that otherwise the rest of the budget was exposed to only the 4.9-percent reduction across the board. We felt this would be the best way to protect the priorities of the President and Congress.

Initially, this resulted in a $13.3 billion budget authority reduction in fiscal year 1986 to achieve the $5.1 billion in outlays. This is principally due to the relationship between budget authority and outlays in the slower spending procurement accounts where you have to reduce more budget authority than outlays to get a prescribed amount of outlays saving in the first year.

The Department was required to supply a detailed sequestering plan to OMB on January 10 in order to incorporate it into the overall OMB report. I should point out we did work closely with OMB and the Congressional Budget Office and General Accounting Office throughout this whole process and there was a good sharing of information and assumptions. I think everyone would have liked to have had more data available earlier but it was a burdensome procedure to go through the first time around.

The General Accounting Office reviewed the reports submitted by OMB and CBO and, as I mentioned earlier, determined that the $6.3 billion in congressionally directed transfers exempted from our base should be added to the sequestering base. This added $300 million in budget authority to be sequestered so our final result was a $13.6 billion reduction in budget authority to get a $5.1 billion reduction in outlays.

Sequestration will legally go into effect March 1, 1986. Until then, the funds at issue have been withdrawn by my office from the services and we are awaiting the March 1 implementation.

In addition, the services have been given some guidance on how to deal with programs which are below the program, project, activity level to assure that priorities are protected during execution.

Mr. Chairman, there is a lot of interest about the impact of sequestering on defense in fiscal year 1986. We have representatives of the services here who can talk in some detail about specific programs. I should point out that sequestering has not been implemented. These reductions will eventually go down to the lowest level of the services down to the program manager, base commander level, and they are going to have to decide how to deal with having 5 percent less in fiscal year 1986.

Congress authorized and appropriated specific programs in 1986. Essentially Gramm-Rudman deliberately underfunded each program by 5 percent and that is going to be a unique management burden on program managers to figure out how to keep their programs going with 5 percent less than they originally thought they would have.

Mr. HUNTER. Have you issued any directives for handling that? I understand that is on individual accounts, so if you are building this widget, so many of them for so much money, you are telling your program manager you have 5 percent less, but you are not issuing directives as to reducing some particular quality of the widget, you are simply saying you figure out who handles the thing and report back to us. Is that what you are doing?

Mr. HELM. Practically, sir, that is the way it has to work. There is going to be two ways this is handled. Some program managers are going to decide that they have sufficient reserves, be they engineering change orders or reserves for economic perturbations, that they can eliminate to the 5-percent reduction without perturbating program quantities.

For other programs, some of which are in negotiation now, it may be that we won't be able to procure quite the quantities we thought we would with the original authorization and appropriations, given this 5-percent reduction. Practically speaking we are just going to wait and see what the program managers say. They know or are learning that they have 5 percent less now and it is going to take some time to have the word come back up to OSD, if you will, on what the implications are. So we are going to have some lagtime here in really getting a handle on the——

Mr. HUNTER. How many programs are touched by this 5 percent again. This is 1986?

Mr. HELM. There are about 4,000 PPA's in the budget.

Mr. HUNTER. That are touched in 1986 by this 5-percent reduction?

Mr. HELM. That are touched in 1986, yes sir. So it is a voluminous number. Each one is getting 5 percent——

Mr. HUNTER. Is one of the alternatives to reduce the number of personnel managing that procurement? Does that have any effect on——

Mr. HELM. That might be one of the options that is selected by that program manager, yes sir. It certainly is an option.

Mr. HUNTER. He can cut down his staff——

Mr. HELM. Yes, sir.

Mr. HUNTER. When are we going to have the details of when Gramm-Rudman is going to shake out?

Mr. HELM. It is going to take some time for that to filter up. Basically, at my level I am going to try to take a 30-day look at the end of March and see what we know and try to develop a cumulative type assessment of what is happening. But we won't know overnight what the impact is going to be. It is going to have to be implemented and dealt with in a management sense at a very low level of the Department.

Mr. HUNTER. Could I suggest one thing that came up at the Naval Institute I was speaking at, had the privilege of speaking at, with a number of active admirals, moderated by an Admiral Davis in San Diego. One thing that came up between the admiral, in this personnel thing, we may not have the Washington Monument syndrome where you tell the Park Service to cut some moneys out of their account, now we have to close down the Washington Monument, keep those typewriters clicking away back in the office.

It was suggested that the tooth-to-tail ratio in our services, I think when I was in Vietnam it was something like for every man in the field we had six guys supporting him, doing the work of the bureaucracy. So it was six to one. We may have to change that tooth-to-tail in the Navy and the Army and the Air Force, and we may not have these catastrophic reductions, 282,000 people that you talk about. That was brought up by a number of these active duty naval leaders, all admiral grade, who thought we could make significant reductions in the tooth, I think the consensus is we could make reductions in the tooth-to-tail ratio, keep the same number of people on the ships even without OPTEMPO, but to reduce the large band of bays of personnel who support them here in the United States doing the bureaucracy of the services. Have you focused on that?

Mr. HELM. Well, reducing this so-called tooth-to-tail ratio has been an initiative of the Department for some time and I think the Department has made some progress over the past several years in cutting down that ratio. In fiscal year 1986, of course, this was something we didn't have to deal with explicitly in terms of reducing military end strength because of the exemption capability. That will not exist in the fiscal year 1987 provisions. It would depend on the magnitude of the reduction, percentage reduction that was required——

Mr. HUNTER. I understand that. What I suggest is that you might take a look at that as a possibility. From what I got from our naval leaders was that if you people voluntarily reduce their tooth-to-tail ratio, it is something that seems to naturally grow larger and larger and I think Admiral Davis commented on some of the func-

tions that a lot of our staff people do correspond with the extra people on other staffs. I just started with a grenade and the Navy leaders seemed to carry the fight quite well with each other, but I thought that that is something that perhaps we need to start on and you might consider the possibility of finding out precisely what it is with each service.

Mr. HELM. Yes, sir.

Mr. HUNTER. What it has been historically and maybe a directive to try to bring it lower this year, so that we find out if we really have slack in it, if we can do some things back here, things you couldn't do before with finance and other areas, and maybe be prepared for the storm next year.

Mr. HELM. Yes, sir. I think you can feel confident that that sort of thing will be looked at.

Mr. HUNTER. Could you let the committee, full committee and this committee, know when you do something with this, if you do, trying to prepare for next year, what you do. I am on personnel, I know we are going to be very concerned there.

Mr. HELM. Certainly be glad to respond.

Mr. HUNTER. I really appreciate that.

Mrs. HOLT. Mr. Chairman, in the question that I asked right in conjunction with what Mr. Hunter said, will you know the economic impact of whatever we do? Is there going to be anybody looking at that aspect of it?

Mr. HELM. I am sure that as we become more acquainted in a detailed sense on the program——

Mrs. HOLT. You can say how many jobs this is going to cost and what actually that would really spell out?

Mr. HELM. It is going to depend on what sort of impact that reduction inevitably has on the quantities of systems, the quantities of items that are actually procured. If we are cutting down quantities I suspect that would impact on the work force and things like that. If it can be handled, absorbed in the reserves of the program that is going to impact on program management, but not so much on the economic impact. We will attempt to provide something for you, Mrs. Holt, but I won't know this overnight is the point I am trying to emphasize to the committee. We are going to have to collect it on a cumulative basis and try to develop a picture over several months, but we would be glad to.

Mrs. HOLT. This is what concerns me. It seems to me that we have panicked into this thing and we really don't have sound assumptions at all. We are seeing oil prices drop that should have a tremendous impact on the defense budget, on all of our budgets, should have an impact on the economy and we may come up with some surprises. And I just don't want us to rush into something that we are going to regret and/or that we are going to get stuck with.

We have a tremendous battle here in the Congress to support the 050 function anyway in good times and bad, and so when we knuckled under and come in saying we can get along with so much less, then we are going to be stuck with the less whatever appropriations does to us, and budget does to us, and Senate does to us, or whatever. So I hope that we are looking at all of the factors and

putting up a strong defense against this panic reaction that is my concern as to be sure we are looking at everything.

Mr. HELM. Yes, Mrs. Holt.

Mr. STRATTON. Mr. Helm, you suggest that the force structures should not be cut. Doesn't that mean that we are going to, if we are going to keep the force structure, how are we going to equip it, we are going to run out of money before we have an opportunity to provide weapons for the force structure.

Mr. HELM. Well, Mr. Chairman, the force structure that we have got planned and programmed right now is of course tailored to the weapon system force structure that is being requested, so you are right, there is a relationship. In fiscal year 1986 we are not talking about a reduction of the magnitude that should have an immediate impact on our forces around the world in terms of the size of the force. The fiscal year 1986 sequestering provisions were deliberately kept low by Congress. It was sort of a test case, a shot across the bow, if you will.

In fiscal year 1987, if there is a significant reduction required, obviously there will have to be a relationship between end strength and the force structure and the weapons systems that we are talking about. That will have to be determined by the size of the deficit in 1987 and the possible sequestering that is required.

In 1986 if we would have reduced 280,000 military personnel, we would probably have been required to get rid of people before the weapons systems were reduced. With the military end strength exemption have a balanced force structure between people and the weapon systems that they require to do their mission around the world.

Just to conclude very quickly, Mr. Chairman, we are in the process now of determining how this 5-percent reduction is going to be implemented. As I said, we are under direction from Congress to implement specific budgetary programs. We simply have 5-percent less to do it with in fiscal year 1986 than we originally thought. That creates a good deal of turbulence for program managers and others who have that amount of funding dropping out from under their feet. We will try to protect program execution at all costs.

This is a $13.6 billion sequestering reduction on top of $24 billion legislative reduction and that creates additional uncertainties.

We tried initially to identify the programs we thought required the maximum protection given the speed that sequestering occurred under, the limited time we had to deal with all of its implications. It is very possible we have missed a few. We may find out in the next few months that certain programs are going to be adversely impacted by this 5-percent reduction. In some cases contracts may be broken by this 5-percent constraint. If that is the case, we would plan on coming back to Congress, and requesting, I suspect, reprogramming approval from the Congress to try to fix these things which were inadvertently broken by the Gramm-Rudman plan.

Just to conclude on this issue of flexibilities, I have been asked a lot about flexibility. Currently Gramm-Rudman doesn't provide any flexibility whatsoever in fiscal year 1987. It is a straight mechanical percentage reduction. Obviously in the future, the Department would be interested in seeing some sort of a personnel flexi-

bility still exist. If we were required to sequester a large amount next year, in 1987, obviously we could not exempt the entire military personnel account from sequestering because you would push too much of the burden on the procurement, O&M and other areas, because you have to save a specific amount of money. If you do not take it out of personnel you have to take it out of other areas. There is a limit in the flexibility you can exercise if the dollar number you have to reduce is very large. You just can't totally protect military personnel.

Another issue I would comment on is the definition of a PPA. For 1986 it was very detailed—each line item was a PPA. That is a low level of management detail to go to. In terms of giving the Department maximum flexibility to manage reductions in the most rational way, I would suggest that the Congress consider taking the definition of PPA to the highest aggregate level possible. Personally, I would suggest the appropriations account level as a level which would give the Department maximum flexibility in trying to protect the goals of the program that was approved by Congress and still accomplish the reductions.

I understand that the reason PPA definition was put at such a low level was to assure that there was visibility on what was happening to congressional priorities. I am certain some sort of arrangement could be worked out between the Department and Congress to ensure that the congressional priority got the visibility that was desired while providing maximum management flexibility.

Finally, I would just say somewhat the same thing about the requirement that congressional add-ons not take more than the standard percentage reduction. Congressional add-ons occurred in the pre-Gramm-Rudman environment. It may be that if sequestering goes into effect Congress would agree that its add-ons take on a lower priority than other programs and it may be that the Department could communicate with Congress to suggest that perhaps congressional add-ons be subjected to the same sorts of procedures as other programs.

So, Mr. Chairman, I would conclude with that and be happy to respond to questions from the members of the committee.

# STATEMENT OF
# THE ASSISTANT SECRETARY OF DEFENSE (COMPTROLLER)

## ROBERT W. HELM

## BEFORE THE
## SUBCOMMITTEE ON PROCUREMENT AND MILITARY NUCLEAR SYSTEMS
## OF THE
## HOUSE ARMED SERVICES COMMITTEE

## IN CONNECTION WITH
## THE BALANCED BUDGET & EMERGENCY DEFICIT CONTROL ACT OF 1985
## (PUBLIC LAW 99-177)

## FEBRUARY 24, 1986

## Introduction

I am pleased to appear here today to present the methodology used by the Department of Defense to implement this legislation. We spent a great deal of time studying the legislation to ensure (1) compliance and (2) a plan that would cause the least disruption to program execution.

Because the Gramm-Rudman-Hollings reductions were in addition to those already made in the normal congressional process, it was essential that implementation first cope with the intent of the Congress in the Continuing Appropriations for FY 1986, and then proceed with application of the Gramm-Rudman-Hollings reductions. Issues such as programs appropriated but not authorized, as well as undistributed congressional reductions were complications that had to be dealt with in the short time available for compliance.

In total, the sizeable cuts made now bring the FY 1986 defense program well below the FY 1985 level. This was recognized as having the potential to lessen our

ability to strengthen and rebuild our defense forces. It was in this context that we endeavored to understand the overall provisions of the law, and particularly as it would impact our ability to execute defense programs.

Next, we had to determine the basic groundrules and criteria that would assist us to establish the methodology for implementation. We wanted to ensure that the resultant impact on national security would be minimized to the extent possible.

<u>Flexibilities</u>

The Balanced Budget and Deficit Control Act -- while imposing one half of the required reduction on defense -- provided some flexibilities for defense. Although the flexibility is limited to FY 1986, it enabled us to make some selected decisions to protect vital defense programs and force structure. An important flexibility was that the Military Personnel accounts could be exempt from reduction. Also, specific programs, projects, and activities (PPAs) of defense accounts could be exempt, and contract terminations could be made with certain provisos.

## Restrictions

At the same time, this legislation also included some restrictions that could neutralize the positive aspects of the flexibilities. For example, even though contract terminations could be made, we were not permitted to terminate a program; nor could base closures or realignments be started as a direct result of Gramm-Rudman reductions. Also, while we could exempt specific PPAs, the legislation still required the percentage cut to be made from other PPAs within the same appropriation account, to compensate for the exemption. Another restriction that we feel is unreasonable relates to congressional adds, or PPAs that are 10 percent (or more) above the amount requested by the President. These PPAs could not be reduced by more than the overall percentage applicable to all other PPAs.

## Groundrules/Criteria for Defense Base

Once having analyzed these provisions, we set about the business of determining the basic groundrules and criteria to use in establishing the defense base from which the Gramm-Rudman reductions would be made.

Mr. STRATTON. Mr. Secretary, how many new multiyear contracts are we going to be requesting in fiscal year 1987?

Mr. HELM. I believe there are seven new multiyear contracts in the 1987 budget request, Mr. Chairman.

Mr. STRATTON. Could you give us a list of those? These are going to be difficult to work in, are they not?

Mr. HELM. Well, if sequestering doesn't occur they will be no more difficult than normal years, Mr. Chairman. Obviously if there is a large sequestering then and with the inability to exempt anything in fiscal year 1987, not only new multiyear contracts but old multiyear contract programs could be potentially affected as we try to hit a very large sequester target.

The seven new multiyear candidates for fiscal year 1987 are the UH/EH-60 helicopter air frame, the Stinger missile system, the Patriot missile system, the F/A-18 aircraft for the Navy, the MK-45 gun mount, and then both the Navy and Air Force have multiyear candidates for the Harm missile program and finally there is the Defense Support Program. Those are the seven different multiyear contracts proposed for 1987.

Mr. STRATTON. Well, with a multiyear contract that is exempt isn't it?

Mr. HELM. It would be exempt in fiscal year 1986 under the current provision of Gramm-Rudman. If these programs were approved by Congress this year, at the level that was requested, and sequestering kicked in later under the provision of Gramm-Rudman, these programs would have to take the standard reduction. If it was a large percentage beyond the ability of the contract to adjust to, we would be in a fix, you are absolutely right.

Mr. STRATTON. Mrs. Holt, any questions?

Mrs. HOLT. A good briefing.

Mr. STRATTON. Mr. Ray, any questions?

Mr. RAY. No questions.

Mr. STRATTON. Mr. Spratt.

Mr. SPRATT. Mr. Helm, welcome and thank you for your testimony.

Last year we made some changes in the SAR. It appears that the revised SAR's will not be available until well into the markup period, possibly even beyond the point in time when we have reported out—at least out of our subcommittee—the procurement authorization bill.

Would you agree that we need the SAR's for budget review and for our markup exercise and if so, could we reach some agreement on an earlier submission date so it would be more in sync with when we now have to report our authorization bill?

Mr. HELM. Mr. Spratt, you are right. Traditionally the Congress has identified the SAR documents as one of the official reporting documents that is required to support the legislative process. As you know, my office is responsible for essentially overseeing the preparation of the SAR's. We are striving to meet the dates.

As you know, it is a voluminous data preparation requirement. I will personally try to work with the committee and the staff to make this information available as soon as possible. We can't create it out of thin air. There is a great deal of staff effort required, but I will try to be amenable to whatever schedule the com-

Lastly, Mr. Stratton mentioned the contribution, that the American contribution to NATO, as I read recently, it was about $180 billion for 1985. Is that in the ball park?

Dr. WADE. Yes, sir.

Mr. RAY. Are we spending that kind of contribution for 1987?

Dr. WADE. Yes, Congressman Ray.

Mr. RAY. Finally, I was really disturbed to learn that in 1978–79 we practically negotiated away all of our rights to our bases in the Philippines and I know that presently we are having—for instance, we have 5 more years there, then thereafter, assuming we will continue as the agreement spells out, we will have a 1 year at a time type renewal whereby the host country can reject us or we can reject them.

This makes it militarily tough to fund long term quality of life military construction. I know we are having a lot of concerns and problems in Spain. The news this week is the population was asking that we get out of certain segments. I wonder do we have a long term arrangement with Spain, or is that a similar type of arrangement whereby they can expel us anytime they want to?

Dr. WADE. As you indicate, a long term arrangement is to our mutual advantage because it provides stability in our program as a whole. Rather than compare our arrangements with our friends in Spain, I would note that we have here a reasonably good agreement.

Mr. RAY. I know the State Department has a tough time, but I don't see how we can continue to put in heavy investments, permanent type investments in any country where our length of stay is indefinite.

I sure thank you for coming before us, and thank you for your answers to these questions.

Dr. WADE. I agree with your last comment.

Mr. SKELTON. Mr. Spratt.

Mr. SPRATT. Thank you, Mr. Chairman.

Dr. Wade, welcome.

One curiosity to me in looking at the issue of out-sourcing some of our requirements was the 9 millimeter Beretta. In looking through the program acquisition cost of the fiscal year 1987 budget, I notice there is a wide variation in pricing of these pistols. The Army is the lead procurer. The Army this year is buying 21,000 Berettas at $207 a copy, Marine Corps is buying 22,000 at $244 a copy, Air Force is buying 24,000 at $353 a copy, and Navy is buying 2,600 at $346 a copy. What accounts for this variation in price that runs from $207 per copy to $353 per copy for what I understand to be the same pistol?

Dr. WADE. Mr. Spratt, I don't have with me the specific details to your question, but let me just observe it is the same pistol. The initial buy is being provided from Italy; then, the production will be transferred to the United States. There might be a detail associated with spare parts and all the backup, but let me look into it.

Mr. SPRATT. Obviously it is not a make or break issue, but it did provoke a question when I saw the variations in the program analysis.

General, do you have an answer? Is it a different pistol?

General WAGNER. No sir, it is the same pistol. The basic difference in what you buy with that pistol, if you buy the bare pistol, with the magazine it is about $212. If you buy the holster with it, and additional magazines, some basic ammunition and spare parts, it will go up and down. If you buy just the bare pistol, we are all buying at about the same price, in the ball park of $210 to $212.

Mr. SPRATT. I see. Thank you very much.

Dr. Wade, Senator Roth and I believe Senator Quayle, as a result of their Government Operations Committee's hearing in the Senate, introduced a bill with a number of procurement changes. This is a little off the topic you have talked about today. While you are here, I would like to ask you, because we may be considering some procurement amendment on the floor in the near future, one is some incremental changes, some improvements to the Truth In Negotiations Act.

Are you aware of the amendment offered to the bill that they have introduced in the Senate, which makes about four changes to truth in negotiations, apparently to correct case law decisions by the ASBCA, which witnesses before their committee indicated were inconsistent with the history and purpose of the Truth In Negotiations Act?

Dr. WADE. I am not familiar at this time with the details, but I certainly can provide those to you later on if you would like.

Mr. SPRATT. We would like your position on it if possible.

[The following information was received for the record:]

### LEGISLATION TO MODIFY TRUTH IN NEGOTIATION ACT

Mr. SPRATT. What is your position on proposed legislative changes to modify the Truth in Negotiation Act?

Dr. WADE. There is not yet a cleared Administration position on this legislation. My personal view, however, is that we should support the Congressional reforms to strengthen the Truth in Negotiation Act. We believe the proposed changes which were under consideration by the Congress would help both avoid defective pricing, and improve our ability to recover funds where defective pricing is discovered. Provisions dealing with reimbursement, interest charges, and penalties for overpayments substantially similar to that portion of Senator Roth's proposed legislation were included in Section 934 of the Department of Defense Authorization Act, 1986.

Mr. SPRATT. Have you taken a position on the restoration of the Defense Cost Accounting Standards Board?

Dr. WADE. Not yet, no sir.

Mr. SPRATT. And they also have a bill which would reinstate this body, I believe placing it under the auspices of GAO?

Dr. WADE. Yes sir.

Mr. SPRATT. No position?

Dr. WADE. Not at this time.

[The following information was received for the record:]

### LEGISLATION TO REESTABLISH THE COST ACCOUNTING STANDARDS BOARD

Mr. SPRATT. What is your position on proposed legislation to re-establish the Cost Accounting Standards Board?

Dr. WADE. We have not supported the re-establishment of the Cost Accounting Standards Board. I do not believe there is a need for an independent board at this time. This position is based on the assumption that the Federal Acquisition Regulatory Council has sufficient authority to perform all the functions that would be performed by the Board.

Mr. SKELTON. Why don't you have a seat. I have some more questions. I am not going to let you off this easy.

General, the Defense Security Assistance Agency [DSAA] is the agency in charge of this, is that not correct?

General WAGNER. That is my understanding. They make the final decision at the Department of Defense level.

Mr. SKELTON. Tell me then, if you can, what the procedure is, from start to finish, to make a determination to sell one of these items or to get one of these items, say, in the hands of the Koreans. Where does it start and in whose shop does it go, and where does it end up in DSAA?

General WAGNER. I can't cover all that. I can tell you when it comes into the Army. It comes into our Deputy Chief of Staff for Logistics, who has a general officer and a directorate that works with the DSAA. They then come to the Army Staff both in the R&D and acquisition side, which is my business, and the operational side. We make recommendations that go back up to the Department of Defense whether that technology should or should not——

Mr. SKELTON. When you say Department of Defense, that is DSAA?

General WAGNER. Yes, sir.

Mr. SKELTON. And what do they do up there?

General WAGNER. Sir, I am not that familiar with who makes that final decision. I think Dr. Wade would be more familiar.

Mr. SKELTON. Doctor, could you tell us who makes that decision up there?

Dr. WADE. There are approval guidelines for a piece of equipment. DSAA will provide a staff paper that they send around for appropriate review, by the senior staff within the office of the Secretary of Defense. If there is a problem, no agreement, it will be raised either to the National Policy Disclosure Committee, finally to the Secretary of Defense.

Mr. SKELTON. According to the testimony we just had a few minutes ago, two of these items that Koreans are selling might have some serious implications should potential adversaries get them. How did those slip through the cracks?

Dr. WADE. I will have to go back and look at that case.

Mr. SKELTON. I would like, for the record, to reflect your answer on that, sir. If you would supply it, and would you also be kind enough to supply it to me personally? Sometimes they are put in the record and I don't see them for 6 months. I would appreciate that very much.

Dr. WADE. Yes, sir.

Mr. SKELTON. I have another question. It deals with national security. It is in general this same vein and reluctantly, but I will have to use my prerogative as acting chairman, to close this meeting for national security reasons and ask those people who are not properly cleared to leave the room so I may ask you a series of questions.

[Whereupon, at 2:15 p.m., the subcommittee proceeded into closed session.]

[The following information was received for the record:]

## M60A3 TANK THERMAL SIGHT/NIGHT GOGGLES

Mr. Skelton. According to the testimony we just had a few minutes ago, two of these items that Koreans are selling might have some serious implications should potential adversaries get them. How did those slip through the cracks?

LTG Wagner. There are some fifteen major kits required to convert the M60A1 tank to the M60A3 configuration. Of these, only the AN/VSG-2 thermal sight involves sensitive manufacturing techniques that we would not want in the hands of our adversaries. Our records show that Korea's only request for technical data on the M60A3 tank thermal sight (AN/VSG-2) was denied by DoD on 13 July 1984. Korea did receive approval from DoD in September 1984 for manufacturing drawing packages for castings for the AN/VSG-2 tank thermal sight including supplementary repair and test procedures. These data were requested to support the XK-1 tank development program. Technical data on thermal electronics however, were specifically excluded from this release. In addition, in November 1984, Korea requested and received a limited quantity of tank thermal sight and laser rangefinder components specifically manufactured by Texas Instrument for the M48 tank. DoD concurred with this transaction. The Army is not aware at this time of any efforts by the Koreans to market the M60A3 tank thermal sight.

With regard to the night vision goggles and sights (AN/PVS-4, AN/TVS-5 and AN/PVS-5), all use second generation image intensification ($I^2$) technology. Second generation technology is available commercially from several world-wide manufacturers, although U.S. military systems are assessed as having slightly improved capabilities. Both 1st and 2nd generation $I^2$ devices are available for sale by several U.S. companies to foreign countries on a case-by-case basis.

## Oversight of Army Offshore Procurement

Chairman Stratton: What role do you play in overseeing the Army's procurement of equipment offshore?

Dr. Wade: As Assistant Secretary of Defense for Acquisition and Logistics I am the Principal Staff Assistant and advisor to the Secretary of Defense for management of DoD production procurement including development of policies and standards for the administration and management of approved DoD plans and programs. These responsibilities encompass review and evaluation of DoD component plans and programs to ensure adherence to approved policies and standards. In that connection, I am responsible for reviewing and evaluating the Army's procurement of equipment offshore to ensure adherence to approved policies and standards.

## Defense Trade Balance Statistics

Chairman Stratton: Mr. Secretary, on page 11 of your statement you state that DoD does "not count purchases of fuel, food, construction or support services" when calculating the defense trade balance.

If you do, what happens to the defense trade balance ratio between the United States and its NATO allies?

Dr. Wade: In FY 85 DoD purchases of food, fuel, construction and support services in NATO countries amounted to about $3.2 billion. In the defense trade balance statistics we maintain, we tabulated a total of $5.7 billion of NATO purchases from U.S. sources versus $2.8 billion of U.S. purchases where the principal place of performance was in a NATO country, or a ratio of 2.03: 1 in favor of the U.S. If the $3.2 billion of purchases of food, fuel, etc. are added in, the ratio becomes .95:1. This is not an accurate portrayal, however, because we have no data on the side of the balance representing NATO purchases in the U.S. for similar goods and services. In fact, on U.S. commercial export transactions, the only data included is for munitions-controlled items licensed by the Office of Munitions Control under the Arms Export Control Act.

## Effect on Competition of Acquisition of Foreign Technical Data

Mr. Secretary: On pages 14 and 15 of your statement you mention the role of competition in defense contracting.

Could you tell us how competition is affected when agreements are made with offshore producers that result in the United States' acquiring a producer's technical data package in exchange for a guarantee to that producer to manufacture the item in question?

Dr. Wade: From a long-term perspective, competition would be enhanced. Acquisition of the foreign technical data package provides the opportunity to establish a competitive base in the U.S. for items which were not developed here. Just as in acquisition of technical data packages from domestic sources, we must negotiate with foreign sources for the acquisition of rights. The negotiation strategy is based upon the need to purchase requirements under competitive procedures as quickly and as economically as possible. In some cases, the negotiation results in granting a foreign source an initial production contract. In so doing, we try to cover only that period necessary for U.S. companies to tool up so as to be competitive.

## Maintenance of Domestic Producers

Chairman Stratton: Mr. Secretary, in your statement, you state that "our defense policies direct the maintenance of at least one domestic producer at a minimum sustaining rate for designated major weapons and secondary items".

1. Please provide the subcommittee with a listing of those designated weapons and secondary items. And, please indicate the "minimum sustaining rates".

Dr. Wade: It is a general policy of the Department of Defense (DoD) to require a domestic capability for all critical or essential military items. The implementation of this policy, however, is affected by a number of factors including prevailing economic conditions, the status/health of the U.S. industrial base, and the level of procurement activity. It is the policy of the DoD to pursue competitive procurement to the maximum extent except in circumstances which require restriction in the interest of national security. This requires and receives constant assessment.

## MINIMUM WORKLOADS FOR US GOVERNMENT-OWNED FACILITIES

Mr. Stratton. What are the minimum workloads for U.S. government-owned facilities?

Dr. Wade. Our goal for minimum workloads at government-owned facilities is 85% of one-shift capacity. Applying this goal to active production lines ensures that we retain the critical management, engineering and production skills necessary for both rapid production ramp-up for surge and mobilization on the active lines and minimum reactivation time for the laidaway lines at those facilities.

## WORKLOAD TRENDS FOR GOVERNMENT-OWNED FACILITIES

Mr. Stratton. Mr Secretary, what have been the workload trends over the last 5 years at our government-owned facilities?

Dr. Wade. The attached table shows the workloading for Army facilities from 1981 through 1985.

Figures shown are end-of-year strengths for management and production workers by installation

| INSTALLATION | 81 | 82 | 83 | 84 | 85 |
|---|---|---|---|---|---|
| Anniston | 4713 | 4707 | 4785 | 4907 | 4707 |
| Corpus Christi | 3097 | 3291 | 3844 | 4053 | 4107 |
| Ft. Wyngate | 89 | 96 | 107 | 98 | 95 |
| Letterkenny | 4329 | 4342 | 4376 | 4505 | 3903 |
| Lex. Blue Grass | 1103 | 1102 | 1241 | 1149 | 1137 |
| Navajo | 116 | 0 | 0 | 0 | 0 |
| New Cumberland | 3336 | 2889 | 2925 | 2468 | 2844 |
| Red River | 5188 | 3806 | 6140 | 6588 | 5799 |
| Sacramento | 2630 | 2641 | 3092 | 3232 | 3218 |
| Savannah | 233 | 255 | 273 | 531 | 249 |
| Seneca | 694 | 710 | 1009 | 851 | 886 |
| Sharpe | --- | --- | --- | 1399 | 1323 |
| Sierra | 589 | 597 | 708 | 621 | 577 |
| Tobyhanna | 4004 | 4006 | 4042 | 4246 | 4227 |
| Tooele | 3849 | 3849 | 4044 | 3974 | 3768 |
| Umatilla | 283 | --- | 279 | 285 | 269 |
| RIA | 2820 | 2908 | 3008 | 3008 | 3051 |
| WVA | 2172 | 2208 | 2733 | 2205 | 2204 |
| DATP | 2131 | 2131 | 2420 | 2420 | 2420 |
| Lima | 1916 | 2927 | 2832 | 3091 | 3091 |
| Stratford | 4938 | 5060 | 4339 | 4279 | 4500 |
| Morton Thiokol | 580 | 643 | 730 | 720 | 690 |
| Crane | 868 | 900 | 900 | 1944 | 1691 |
| Hawthorne | 571 | 571 | 765 | 714 | 639 |
| Holston | 1021 | 1026 | 1042 | 1074 | 1182 |
| Indiana | 1611 | 1590 | 1585 | 1843 | 1851 |
| Iowa | 958 | 889 | 956 | 941 | 966 |
| Kansas | 768 | 790 | 861 | 903 | 1275 |
| Lake City | 1782 | 2557 | 2675 | 2864 | 3104 |
| Lone Star | 1331 | 1276 | 1282 | 1707 | 2031 |
| Longhorn | 634 | 809 | 882 | 913 | 958 |
| Louisiana | 889 | 947 | 1142 | 1943 | 1399 |
| McAlester | 934 | 821 | 1002 | 834 | 675 |

| INSTALLATION | 81 | 82 | 83 | 84 | 85 |
|---|---|---|---|---|---|
| Milan | 1272 | 1311 | 1664 | 1756 | 1895 |
| Mississippi | 105 | 114 | 677 | 1266 | 1369 |
| Pine Bluff | 1142 | 1162 | 1309 | 1227 | 1387 |
| Radford | 3176 | 3193 | 3483 | 3859 | 3838 |
| River Bank | 82 | 118 | 221 | 254 | 289 |
| Scranton | 933 | 654 | 693 | 677 | 794 |
| Sunflower | 572 | 515 | 491 | 729 | 828 |
| Volunteer | 153 | 152 | 153 | 208 | 201 |

## Technical Data Acquisition

Chairman Stratton: Mr. Secretary, please discuss the considerations involved in negotiating acquisition of technical data packages from foreign producers. How prevalent is the practice of negotiating an agreement which provides guaranteed production rights for a foreign source? How can you accommodate concerns for both the domestic mobilization base and fair competition?

Dr. Wade: When a U.S. negotiator is faced with needing to obtain rights to Technical Data from foreign sources, the going in position is to attempt to obtain the rights by the payment of royalties only, or if absolutely necessary by payment of a lump sum in lieu of royalties. From a long-term competition vantage, the issue is the same on technical data rights acquisition from a foreign firm as it is for a domestic firm. We must balance the need to acquire the rights for the purpose of enhancing competition while not stifling the initiative of industry to develop leading edge technologies without our funding. There is an additional issue driving the acquisition of technical data rights held by a foreign source, however, and that is the need to make some provision for production domestically to insure a mobilization base is established. In negotiating a license with reasonable royalties and granting a foreign source the initial production contract, we try to cover only that period necessary for American companies to tool up so as to be competitive. Where this position is not accepted, we try alternate schemes always keeping in mind that our requirements must be purchased under competitive procedures as quickly and as economically as possible. For example on the L119, the negotiator was able to negotiate a proposal with the Royal Ordnance for simultaneous co-production with the U.S. producing 60% of the U.S. requirement and Royal Ordnance 40% until the U.S. purchased a minimum of 100 weapons, 75 carriages, 25 trails and $5 million pound sterling spares, repairs, components, assemblies, etc. from Royal Ordnance. The remaining quantity of over 400 weapons will be totally U.S. produced.

## Arsenal Act

Chairman Stratton: What is DoD's interpretation of the Arsenal Act? At what point is the statute operative?

Dr. Wade: The Arsenal Statute, 10 U.S.C. 4532(a) requires the Secretary of the Army to have supplies made in factories or arsenals owned by the United States so far as those factories or arsenals can make the supplies on an economical basis. The term "factories" includes both Government-owned Government-operated, and Government-owned contractor-operated industrial facilities.

The term "economical basis" means at an overall cost to the Government which is equal to or less than the cost if manufactured in a contractor-owned contractor-operated plant. Overall cost must be computed on the basis of actual out-of-pocket costs to the Government. The Comptroller General has stated that the statute expresses a requirement that Government-owned industrial facilities should not be permitted to lie idle if it would be possible to use such facilities at a cost to the Government no greater than the cost of procuring such needs from private industry.

The requirements of the Arsenal Act apply to the Secretary's make or buy decision concerning items which an arsenal or factory can make. The Act applies to all acquisitions of items where an arsenal or factory has the capability to manufacture the item on an economical basis. Where such a capability does not exist, the Act would not be applicable. In the case of the competing 120 mm mortar systems, for example, the Army does not possess the requisite technical data package to produce the winner's item at this time. Accordingly the arsenals or factories are not in a position to independently manufacture such 120mm mortar components on any basis. The requirements of the Arsenal Act, therefore, cannot be applied until such time as arsenals or factories have the technical data required to produce the winner's 120mm mortar components.

A different rule applies where Arsenals or factories act as subcontractors. Government property and services, including items manufactured by arsenals, may only be sold pursuant to statutory authority. Accordingly, Arsenals may enter into subcontracts with private industry only when specifically authorized by statute. Existing statutory authority generally requires full reimbursement rather than "out of pocket" costs. Additonally, the Arsenal Act does not itself provide authority to sell supplies to private industry. Accordingly, the prices charged by arsenals in a sale to a contractor are those established by the statute authorizing the sale.

It should be noted, furthermore, that there is a variation to this theme where Government-Owned Contractor-Operated (GOCO) Arsenals or factories are involved. In such a situation, the operating contractor is available to sell items it manufactures in the GOCO to other contractors upon obtaining the approval of the Government to use the Government-owned facilities for such manufacture. This case should be distinguished from that of a Government-Owned Government-Operated Arsenal such as Watervliet or Rock Island where specific statutory authority is required for sales of manufactured items or services.

Mobilization Base Restricted Procurements

Chairman Stratton: Mr. Secretary, in your statement, you state that "certain procurements are reserved for domestic mobilization base suppliers". Which procurements are those? What do you mean by "reserved"? Does that suggest that these items are only procured on-shore?

Dr. Wade: According to authority provided under 10 U.S.C. 2304 (c) (3) as implemented by Federal Acquisition Regulation (FAR) 6.302.3, certain procurements are restricted to domestic suppliers to insure that related facilities, producers, or manufacturers are available for furnishing supplies or services in the interest of national security or industrial mobilization. Use of this authority may be appropriate when it is necessary to:

(1) Train a selected supplier in the furnishing of critical supplies or services, prevent the loss of a supplier's ability and employees' skills, or maintain active engineering, research, or development work;

(2) Maintain properly balanced sources of supply for meeting the requirements of acquisition programs in the interest of industrial mobilization;

(3) Limit competition for current acquisition of selected supplies or services approved for production planning under the Department of Defense (DoD) Industrial Preparedness Program to planned producers with whom industrial preparedness agreements for those items exists, or limit award to offerors who agree to enter into industrial preparedness agreements;

(4) Create or maintain the required domestic capability for production of critical supplies by limiting competition to items manufactured in the United States or the United States and Canada;

(5) Continue in production contractors that are manufacturing critical items, when there would otherwise be a break in production; and,

(6) Divide current production requirements among two or more contractors to provide for an adequate industrial mobilization base.

Examples of restricted items include: the XM 233 105mm cartridge, the M712 Copperhead, cannon launched guided projectiles, 25mm ammunition, the M16A2 rifle, AN/VRC-12 series radio set, the Hellfire modular missile system, chemical defense equipment, precision optics items, high carbon ferrochrome, forgings, high purity silicon, jewel bearings, and mechanical aircraft clocks. During FY 1985, the DoD initiated procurement actions valued at approximately $11 billion for products and services costing more than $25, 000 that meet the criteria set forth in 10 U.S.C. 2304 (c) (3).

ages and still do target identification and location as long as we put on a laser range finder to get the range accuracies.

Ms. SLATKIN. Your answer to the question was yes. Does that suggest that there is a [deleted] representative informing the Army as to what the RFP does through the Department of the Army Headquarters?

General KNUDSON. Some of both. We sent the program developer team to [deleted] to interview with them and work it. We also had members of this crew to include some of the contractors support people participate in that. We continued as of even yesterday to have the Director of Development, Lt. Gen. Moore of AMC, going through how much of what we have done, that we have considered in this RFP.

I think some of the things that are are still worried about is reliability. That you have to consider this thing, in my mind, a little bit more rigid in terms of what happens when you have to handle it under alternate techniques.

The quality of the data link is vital. If you don't have quality data link you lose control, if you lose control it disappears, things will happen.

When I am flying a helicopter and the engine quits, I expect to get it to the ground without killing myself and have done so any number of times, but you don't have a man on the RPV. I think we need and have told the contractors you must improve the quality of the alternate landing techniques, higher assurances that the parachute or whatever will work, and higher assurances that when it does work you will bring the equipment down without catastrophic damage to payload or vehicle.

Ms. SLATKIN. Thank you.

Mr. SCRIVNER. Mr. Fredericksen, I would like to return to the overall program management structure. In your statement you talk about a road map basically, a compendium of programs or does that represent some prioritization of programs? Is this road map going to be updated continuously?

You also mentioned that the acquisition plan isn't quite in place yet. Are you saying there that you have some sort of a broad structure but you have not made decisions yet on how you are going to proceed with acquisition? First question.

Second question relates to your statement I believe that there is going to be a review later this year at the OSD level with regard to this program.

Does that review include all the requirements that the services have established for their RPV programs? What is going to be your input into that whole process, and second, I believe one of the witnesses mentioned tradeoff analysis. Where do you play in that? When will the result of that analysis be available?

Mr. FREDERICKSEN. On Aquila we plan, as I said, to have a review, probably late in the spring, when DT–II testing is completed. We are also going to initiate a blue ribbon independent look at Aquila to scrub its costs.

Mr. SCRIVNER. I am talking a little bit beyond Aquila; I am talking about the overall RPV community, if you will. I am not sure——

Mr. FREDERICKSEN. As you have seen today, Aquila dominates the picture and except for a few smaller items, most of the procurement that shows up in today's budget is the Aquila.

With respect to projections of procurement budgets, it depends on how some of these things come out. We have a number of joint programs under way where services are trying to define the requirements in detail. They have agreed on broad objectives and we just have continue to work the problem. We have a constrained budget and we have got to make sure that wherever we can apply one service's solution to another services problem we can do so.

I think the services are conscientiously working this problem. I think the problem in projecting what the procurement funds are going to be, 1990-91 period, can't be solved until we have defined the systems, for example, the median-range system that the Navy and Air Force are working on. It is not clear what that system is going to do, and they are still trying to define something that will meet their need at a minimum cost.

Mr. SCRIVNER. Are you saying then that the road map is more at this point a sort of listing of programs and that you really haven't established priorities?

Mr. FREDERICKSEN. Priorities? Priority means you have eliminated something. In lethal areas, there were some things eliminated.

Mr. SCRIVNER. What area?

Mr. FREDERICKSEN. In the lethal RPV area, which you can call a missile. It is not clear on a one-way mission where you are killing things whether that is a missile or a lethal RPV. There was [deleted] an RPV eliminated and priorities were sorted out. We are constantly looking at the priorities.

Army, for example, has cut down their total Aquila numbers because they are looking at how they can do the easier missions. The tough mission is designation, but reconnaissance is a lot easier mission. You can get by with a lot lower cost vehicles; you don't have to have the same equipment packages.

General KNUDSON. I think something that we need to remind you of is the Joint Requirement Management Board [JRMB] which the Vice Chairman of all four services perform the program review, which I chair the panel. That was not a one-time review. I have a chart that we did for those four-star generals and the Secretary of Defense and they approved the basic plan for the short-median and long-range RPV's. They further charged that the JRMB continue to monitor and manage the requirement of the services in these program areas and that we conduct quarterly review, at the JRMB level, of progress toward the maturity of the program plan for UAV's.

Further, I don't want to say the effort that took place is that directed by either the SASC or HASC in the last years, language on the RPV procurement for the Army budget. The JRMB task to review all mission equipment packages for unattended aerial vehicles and report the result of that review to the committee is not yet done. That task is ongoing. I am also the chairman of that task and that same group. In the previous report we said there is great commonality or opportunity for commonality in the area of mission equipment package. I believe that language was put in because we did provide this briefing to the senior staffers of each of both the

House and Senate appropriation authorization side when we completed the review last year sponsored by the DDR&E.

Mr. FREDERICKSEN. I want to add something on the Air Force/Navy Medium Range Program. This summer there will be a DSARC on the Air Force ATARS Program which includes RF-4C, includes pods for new aircraft, for reconnaissance, and unmanned aircraft. During that DSARC, we will be sorting out the priorities for how the money is going to be divided among these three things; that is certainly a priority issue so to speak.

Mr. SCRIVNER. Could you provide the subcommittee with a copy of that road map?

Mr. FREDERICKSEN. Yes, sir.

[Classified response provided to committee.]

Mr. FREDERICKSEN. I would like to make one point and that is that one of our thrusts over the last 2 years is to encourage experimentation with already developed air vehicles. The reason is that we must overcome the operator apprehension about RPV's based on past experiences. This whole thing is going to work only if the operators find these things useful. We want to get out into the field with some of these developed vehicles so the operators can test and experiment with them; find out how they are operationally useful. The RPV's have to be useful enough so the soldiers can do something with them. We think that there are a lot of things around in the marketplace now that can be used. That has been one of our thrusts. When we get sufficient results back, we will know better where we are going.

Mr. SPRATT. Mr. Hunter, do you have questions?

Mr. HUNTER. I just had a couple, Mr. Chairman, if I could take a second. I do apologize for being late. I think I have got the same problem all our folks do; we have umpteen briefings involved, we are all refighting the battle of Manila today, too.

Let me ask you, it looked to me like there is a great potential for RPV's in antiarmor, in antiarmor configuration, and I was thinking the other day if you stood up here at the Capitol, if you had a piece of armor down by the Washington monument, you could probably go buy an airplane, a little model airplane that you could sail out, guide down visually and run into a tank or an APC or whatever down by the monument, and looking at the places like Afghanistan, it would seem that we could put some RPV's, simple RPV's that basically have little car wrecks with Soviet armor, in places around the world where we could test it.

I think the Israelis have probably done a few things along that line.

I guess one thing I was kind of interested in, you have talked largely of using RPV's for reconnaissance. Is there some resistance in the service, among the services to giving or looking at giving PRV's a role and actually searching for and destroying armor?

Mr. FREDERICKSEN. [Deleted.]

We also have something I think you would be interested in and if you haven't been briefed on this, we probably ought to get it over to you, and that is FOG-M. It is fiber optic guided missile and you can think of it as an RPV. I am not sure what the difference is between RPV that is a Kamakazi and a missile. They are both one way, both designed to destroy targets.

Mr. HUNTER. I think the difference may be that problem you have with the TOW missile. You followed that, you have to visually keep that baby on target, and while you do that you can be shot. In fact, I think Israel had some hellacious problems, wire guided problems.

Earlier in the war they realized when those boys popped up and started guiding their missiles, they needed a 50-caliber machinegun that worked fairly effectively.

The thing I like about the idea about RPV, you could be, I doubt, in driving down the road and seeing some kids flying their planes around a couple hundred yards away, you could be in a river valley in Afghanistan, could have a column of tanks down in the valley, and the thing that gives away the Mujahadeen when they fire on these tanks, and they usually take them on close range and they take enormous casualties when they attempt this, because over that you could fly a remotely piloted vehicle down at this armor and they wouldn't know where the hell you were.

That is the difference, I think, between an RPV and some kind of wire guided or sight guided projectile that you fired from a different position.

Mr. FREDERICKSEN. FOG-M is exactly that kind of thing. It goes about [deleted]. The prototype version is about [deleted] from, of course, a very secure place.

Mr. HUNTER. How heavy and how big?

Mr. FREDERICKSEN. The one they have been experimenting with is [deleted] or something like that. You could make it bigger than that.

Mr. HUNTER. I would be interested in making it smaller so one person could carry it.

Mr. FREDERICKSEN. It is possible to make it smaller although then you would give up some range because the size is in propulsion. In some recent shots, the thing has down range [deleted] and hit a target.

You have a large field of view and one particular shot they [deleted].

We see this potential for killing tanks just the same way beyond the front line with the operator secure in a van far back from the front line. It is exactly the kind of thing you are talking about.

General KNUDSON. I believe one of the issues is the technology to do these kind of tricks is just really turning the corner. Work with programs, DARPA, Air Force, Navy on tracking heat seekers, all of this stuff is coming out of your current leading program like Aquila, Copperhead, et cetera. They are generating microprocessing technology, and sensitive enough, either IR or millimeter wave to see this class of thing and it is that class of weaponry that, as you think as we bring forward our AAWS-M, Dragon Replacement Program. We are really talking fire and forget in FOG-M Program, and that it is practical. It appears to offer a possibility that the next half dozen years will put up that class of munition.

But it is really being turned at the moment mostly by DARPA pushing technology that just in the last 2 years has really qualified for military use, Now the industry is picking it up and industry is going to offer it back to the Government in programs like AAWS-M, AAWS-H and as Government matured technology.

Mr. HUNTER. I would offer, Mr. Chairman, I will close out here, I would offer that instead of a half dozen years, in a half dozen days, you could do something a lot simpler than that, which would be simply to, if you wanted to, you could go out just to kind of test the concept.

A single soldier right now could take a little drone essentially or a pilot airplane, we could take one down to Quantico and sit on it, you got a place where you can see a couple hundred thousand meters, without having a tree line in front of you and you could fly, you could have a soldier launch and fly something on the order of a model airplane into a piece of armor and if you put a warhead on it or put a little exlosive on it, could do something with armor and that is done without a lot of the technology things that we are talking about here and without having to explore a lot of issues that are going to be fairly complex and without involving DARPA's highest resource, I think an individual right now could fly a piece of C–2 or C–4 explosive into a tank at 2 or 3 kilometers right now. You could go down to a model store and get essentially what you needed and slap it together in a couple of days to see if the thing would work.

All I am suggesting, I think we ought to pursue maybe two tracks, the high track with the technology and all of the sophisticated issues that you are talking about; we also ought to follow maybe a crude track or low track which is to simply see if you couldn't build a small, easily something that is easy to carry for the average infantry man without giving his position away. He could launch this little RPV, for example, behind a hill if he was in Afghanistan, come out around the cannon without in any way giving his position away and just like those kids out there on the baseball field, he could guide it down into a piece of Soviet armor and wrap some kind of explosion against that hill.

Mr. FREDERICKSEN. Yes, sir.

Mr. HUNTER. That is what I would like to see you guys pursue. Until they start putting reactive armor on people, you could also—that guy in Afghanistan could lay that thing down in the middle of a small squadron of infantry men.

Mr. FREDERICKSEN. Yes, sir.

Mr. HUNTER. We would have no reason to not go ahead with that type of stuff.

Mr. FREDERICKSEN. Yes, sir.

Mr. HUNTER. I think it is interesting we should explore that low road, is I guess what I am talking about.

Mr. FREDERICKSEN. There is a cheap road being worked. My problem is countermeasures such as jamming and other countermeasures which make it difficult for a simple RPV to operate. We are in a period of extraordinary technological growth. [Deleted.]

Mr. HUNTER. I agree with you.

Mr. SPRATT. Any further comments that the witnesses care to offer?

Thank you very much for your presentation, and if we have further questions we will be in touch with you, I assure you.

[The following questions were submitted to be answered for the record:]

FOR ARMY REPRESENTATIVES

*Question.* Describe the Army's plan for a family of vehicles.

General THOMAS. The Army family of Unmanned Aerial Vehicles (UAVs) will improve/enhance the commanders' ability to accomplish combat oriented functions in support of AirLand battle. These functions include target designation and artillery adjustments; reconnaissance, surveillance, and target acquisition; attack; command, control, and communications; air defense early warning; deception; and meteorological. Based on the functional requirements, the Army categorized the family of UAVs as follows: TADARS, General Purpose and Expendable.

The Army had defined two members of the family of UAVs: Aquila (TADARS) and Corps Intelligence Electronic Warfare (IEW) UAV (General Purpose). Future systems will be added as the Army continues its examination of potential UAV applications, validates requirements, gains operational experience, and approves operational concepts. The Army will submit a report to Congress not later than July 1, 1986, which further defines the categories of the Army's family of UAVs.

*Question.* How does the Army plan to pay for the planned "Family of Vehicles"? How much will this cost over the next five years? What specifically is included in the costs?

General THOMAS. The Army has currently defined two members for the family of UAVs: Aquila and Corps Intelligence Electronic Warfare (IEW) UAV. Additional systems will be added as requirements are validated and operational concepts approved.

Aquila funding follows:

FISCAL YEAR 1987 PRESIDENT'S BUDGET

[In millions of dollars]

| | Fiscal year— | | | | |
|---|---|---|---|---|---|
| | 1987 | 1988 | 1989 | 1990 | 1991 |
| RDTE | 100.1 | 19.4 | 9.2 | 3.1 | 0.9 |
| Procurement | 117.7 | 193.3 | 166.9 | 35.1 | 17.8 |

Fiscal year 1986 funding for the initial unit sets Corps IEW UAV includes $3.9M RDTE and $21.5M procurement in fiscal year 1986. Additional funding follows:

FISCAL YEAR 1987 PRESIDENT'S BUDGET

[In millions of dollars]

| | Fiscal year— | | | | |
|---|---|---|---|---|---|
| | 1987 | 1988 | 1989 | 1990 | 1991 |
| RDTE | 0 | 15.0 | 20.5 | 8.7 | 4.2 |
| Procurement | 0 | [1] 0 | [1] 0 | [1] 0 | [1] 0 |

[1] Corps IEW UAV funding for fiscal years 1988–92 is being developed in the fiscal years 1988–92 5-year defense plan and will be available in May 1986.

Funding for other members of the family of UAVs excluding Aquila follows:

FISCAL YEAR 1987 PRESIDENT'S BUDGET

[In millions of dollars]

| | Fiscal year— | | | | |
|---|---|---|---|---|---|
| | 1987 | 1988 | 1989 | 1990 | 1991 |
| RDTE: | | | | | |
| Amber | 4.9 | 5.0 | 0 | 0 | 0 |
| Other | 0 | 0 | 0 | 10.7 | 15.0 |
| Procurement | 0 | [1] 0 | [1] 0 | [1] 0 | [1] 0 |

[1] Procurement funding for fiscal year 1988–92 is being developed in the fiscal year 1988–92 5-year defense plan and will be available in May 1986

*Question.* What alternatives are available to Aquila? How do they compare as far as cost and schedule.

General THOMAS. There are no immediately available alternatives that provide Aquila's capabilities. Aquila flight operations are automatic. This means that you don't need a trained pilot to fly and navigate it. Aquila has a hardened, two-way data link that prevents the enemy from capturing your air vehicle, from using your transmissions for his own purposes or from jamming your use of the air vehicle. The Aquila is designed to military specifications for world wide deployability and has an on-board laser rangefinder/designator that enables it to designate for laser guided munitions, cue Army and Air Force aircraft to targets and precisely locate targets for artillery fire. We did a study in 1984 comparing the cost of Aquila versus the cost of upgrading several off-the-shelf systems to perform Aquila's mission. First of all let me say that none of the alternatives in that study were modified to possess all the features of Aquila I've just described. Even with that, the conclusion of that study was that, while procurement costs for the off-the-shelf system were lower, the overall program costs were higher because of the additional development required to bring the alternative up to the minimum required capability. This effort would also have extended the fielding of Aquila's capability by at least a year.

## EMPLOYMENT OF AQUILA

*Question.* How do you intend to employ the Aquila?

General WAGNER. Aquila will be a corps level asset attached to the division artillery. Division will allocate the battery as operational requirements dictate. Typically, forward control stations (FCS), would be allocated to the brigades in that division. Each battery would be comprised of two central launch and recovery sections (CLRS) located 30 to 40 km back from the forward line of troops (FLOT), three forward control stations (FCS) located 10 to 15 km behind the FLOT, and 13 air vehicles at the CLRS. A typical mission profile would include:

| | Minutes |
|---|---|
| Engine start to hand off | 20.0 |
| Hand off to forward control station (FCS) | 7.5 |
| Target area missions (2 hours) | 120.0 |
| Hand off from FCS to Central Launch and Recovery Section (CLRS) | 7.5 |
| Handoff to landing | 25.0 |
| Total (3 hours) | 180.0 |

Target area missions include target acquisition, laser designation, artillery adjustment, reconnaissance, and damage assessment. Some or all of these missions would be accomplished during each flight.

## AQUILA

*Question.* How long will it take to hand off the RPV to forward area section?

General WAGNER. The written specification is for 7.5 minutes. However, actual Army experience during DTII has shown that hand off averages between 2–4 minutes.

*Question.* Given the three hour endurance of Aquila, how long do you project that Aquila will be in the target area?

General WAGNER. Two hours.

| | Minutes |
|---|---|
| Engine start to hand off | 20.0 |
| Hand off to forward control station (FCS) | 7.5 |
| Target area (2 hours) | 120.0 |
| Hand off from FCS to Central Launch and Recovery Section (CLRS) | 7.5 |
| Handoff to landing | 25.0 |
| Total (3 hours) | 180.0 |

## TRADEOFFS BETWEEN RPVS

*Question.* What, if any, tradeoffs between RPVs and manned systems have been identified? For example, does the use of RPVs lessen the requirement for scout helicopters or reconnaissance aircraft? If not, why? If so, what budgetary adjustments have been made?

Answer. The Theater Intelligence Reconnaissance and Surveillance Study, which was completed in 1985 by the Air Force, supports a complementary mix of manned

and unmanned penetrating tactical reconnaissance vehicles. The Air Force is currently determining the required mix of systems and tradeoffs. The Air Force will brief their programs supporting this system mix to a Defense System Acquisition Review Council this summer. Budgetary adjustments, if required, will be included in the FY 1988 budget submission.

An unmanned reconnaissance system provides a capability to image fixed targets when manned overflight is not recommended due to enemy defenses or is politically inadvisable. This capability augments, not replaces, the requirement for manned aircraft.

### RPV Effective Deployment Concepts

*Question.* You mention that the Army and Marine Corps are providing hardware to their operators to develop effective deployment concepts and to integrate RPVs into the existing force structure. What is the Air Force doing in this regard?

Answer. The Air Force will not receive any hardware for testing until FY 1988, but we are currently determining the required force structure and operational concepts for manned and unmanned tactical reconnaissance vehicles through the year 2000. Air Force conclusions will be presented to a Defense System Acquisition Review Council this summer and will include an Air Force recommendation concerning the role and contribution of unmanned vehicles to the future reconnaissance force structure.

### Basis for AF RPV Requirements

*Question.* General Loh, on page 2 of your statement you detailed the requirements for the Air Force RPV. What is the basis for these requirements and are they compatible with the Navy requirements?

Answer. These requirements are stated in a draft Air Force Statement of Operational Need that is being coordinated with the major using commands.

Air Force requirements for the medium range reconnaissance vehicles have been harmonized with the Navy and are generally compatible. Differences do exist in command link requirements, operational concepts, and recovery requirements, but they should not be obstacles to joint development and acquisition.

### RPV Technical Difficulties

*Question.* General Loh, you indicate that the RPV has overcome its technical limitations. What are those technical difficulties?

Answer. The last experience the Air Force had with unmanned reconnaissance vehicles was with the BQM-34 during the Southeast Asia conflict. The Air Force had many successful experiences with this vehicle, however navigation system limitations resulted in mission reconstruction problems. In addition, in order to launch and recover the BQM-34, specially configured C-130 aircraft and helicopters were required, resulting in high operations and support costs.

Technology can now provide significantly lower cost, more precise navigation systems that meet unmanned requirements to image fixed targets at known locations. The Air Force requirements for the unmanned vehicle include that it be launched from a manned reconnaissance aircraft and be recovered using a system that allows accurate ground recovery.

[Whereupon, at 3:55 p.m., the subcommittee adjourned.]

Mr. SPRATT. On the antidote?
General WAGNER. Yes, sir.
Mr. SPRATT. Could you break it out by these categories?
General WAGNER. Yes, sir.
Mr. SPRATT. What is for military construction to complete this facilitization, what is there for new offensive munitions, what is there for chemical weapons, and what is on the leading edge of the technology, what you are putting there for defensive technology?

I saw lots of very cryptic line items in the program element implied there were a lot of different research going on in the defense area. It would be interesting to have a breakout.

General WAGNER. If I could, I would like to provide that for the record, it is a long list, I will do that, sir.

[The following information was received for the record:]

### CHEMICAL WARFARE/DEFENSE PROGRAM

The following addresses the $726 million Chemical Warfare/Nuclear, Biological, and Chemical [NBC] Defense and Smoke Program. Part one describes the $587 million defense program and part two describes the $139 million retaliatory program.

#### PART 1.—THE $587 MILLION NUCLEAR, BIOLOGICAL, AND CHEMICAL [NBC] DEFENSE AND SMOKE PROGRAMS

| Program | Millions of dollars | Description |
|---|---|---|
| RDTE: | | |
| Chemical and biological [CB] (defense nonmedical). | 161 | Basic research—detection of biological/toxin agents, enzymatic decontamination. Exploratory development—laser standoff chemical agent detection, biotechnology used for CB detection. Advanced/full scale development—non-water-base vehicle/equipment decontamination systems, several chemical detection systems to include a NBC reconnaissance vehicle, vehicle collective protection system, and chemical hardened shelters. Management and support—joint service testing and assessment. |
| Radiological defense | 4 | Advanced/full scale development of three radiation detection systems. |
| Medical CB defense | 154 | Basic research—CB antidotes, exploit biotechnology for vaccines. Exploratory development—treatment and pretreatment medication for CB agents. Advanced/full scale development—nerve agent, blister agent and cyanide pretreatment and treatment compounds; anthrax vaccine; individual patient resuscitator; generic toxin protection; and decontamination resins. |
| Smoke | 21 | Exploratory development—multispectral smokes and technology to disseminate smoke. Advanced/full scale development—dual purpose smoke/decontamination system; and vehicle smoke systems. |
| Other support programs, NBC defense: | | |
| Dugway Proving Ground [DPG] modernization and force development, test and evaluation. | 22 | Equipment and personnel for chemical warfare and NBC defense testing. Combined arms in a nuclear and chemical environment test. |
| Subtotal RDTE | 362 | |
| Procurement: | | |
| Army war reserve stock fund | 26 | Stock funded NBC defense items, for example, protective overgarments. |
| Operation and maintenance and stock fund procurement for Active Army. | 139 | Operation and maintenance and procurement of stock-funded NBC defense systems, for example medical antidotes and overgarments. |
| Other procurement | 47 | Includes: protective masks, lightweight decontamination apparatus, simplified collective protection equipment; mobile smoke generator; ground radiacmeter and radiation dose reader. |

PART 1.—THE $587 MILLION NUCLEAR, BIOLOGICAL, AND CHEMICAL [NBC] DEFENSE AND SMOKE PROGRAMS—Continued

| Program | Millions of dollars | Description |
|---|---|---|
| MCA | 13 | Includes: Materiel test facility at DPG and community center at DPG. |
| Subtotal procurement and MCA | 225 | |
| Total defense | 587 | |

PART 2.—THE $139 MILLION CHEMICAL RETALIATORY PROGRAM

| Program | Millions of dollars | Description |
|---|---|---|
| RDTE: | | |
| Exploratory development | 12 | Research on incapacitating agents, protective equipment defeating, and lethal agents. Maintains technology in agent chemistry weaponry to avoid technological surprise. |
| Advanced development | 25 | MLRS binary warhead development to include new agent and fuze efforts and warhead design testing. |
| Procurement: | | |
| Projectiles | 61 | Acquisition of the hardware and fill for the 155mm binary round. |
| Projectile facility and proveout | 26 | Completion of the binary chemical component precursor (DC) facility and proveout; expansion of the metal parts facility to balance the production line. |
| Bomb facility | 15 | Expansion of the metal parts facility for the Bigeye bomb in order to meet USAF requirements. |
| Total retaliatory | 139 | |

Mr. SPRATT. What is the total being requested for chemical weapons, all line items together, all program elements together?

General WAGNER. If you took the defense programs and the retaliatory programs, it is $726 million, if I add it right.

Mr. SPRATT. You are adding $139 million to $587 million?

General WAGNER. Yes, sir, $726 million. Now, you understand that the chemical demil used to be carried as a separate line item by the individual services.

That is now carried as a line item in the Department of Defense. We are involved in that, but they are the ones that have that in their budget. Then we work with them on facilities.

Mr. SPRATT. That is the destruction of old waste.

General WAGNER. That is correct.

Mr. SPRATT. Spent waste?

General WAGNER. Yes, sir.

Mr. SPRATT. Thank you very much.

Mr. STRATTON. At this point, we will go into executive session for the purpose of answering some of the questions on the RPV. Those people not cleared, kindly leave the room.

[Whereupon, at 11:20 a.m., the subcommittee proceeded to other business.]

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# INTRODUCTION

In FY87, the Army continues the long-term program of equipping our forces with the systems required to gain a qualitative edge over the Soviets. We ask your continued support in this effort; however, we are mindful of the necessity of reducing the deficit, and consequently remain committed to ensuring the dollars provided us are used wisely and efficiently. The continued Congressional support of the Army's equipment modernization program is paying dividends. As we move into FY87, it is essential that this positive trend continues to enable the Army to eliminate obsolescence, fill shortages, and strengthen our position relative to probable adversaries.

Our ability to measure and articulate changes in unit capabilities over time against a realistic threat force was vastly improved in 1984 with the development of the Measuring Improved Capability of Army Forces (MICAF) Study.

Improvements to the 1984 study have resulted in MICAF 85 which is expanded to provide data showing the capability changes of most divisions, separate brigades, and Armored Cavalry Regiments fighting a 1988 threat. Total Army major combat units warfighting capability improved 39% over the 1980-1985 period compared to a 1988 threat. The relative combat potential of the same force with the equipment projected to be fielded in 1987 is a 52% increase.

The FY87 combined procurement and RDTE request is for $24.2 billion. These funds will continue the improvement of the Army's near-term readiness posture, continue to modernize the total force, and support near and far term research and development. Progress has been made in meeting our requirements; however, the Army is still short the materiel to bring units up to the equipment level they require. Reduction of these shortages as quickly as possible is our highest priority. We must continue to procure additional quantities of equipment—currently fielded, product-improved, and new—for both Active and Reserve Components.

A brief review of the recent history of development in the Army's combat forces, and changes in the character of the combat operations they must prepare for, will help establish a basis for our current RDT&E and acquisition programs.

Fifteen years ago we recognized the need to modernize in all areas, but particularly in our principal weapon systems. At that time the Soviets were developing and deploying weapon systems at rates which indicated that they intended to establish a clear numerical superiority over the US and its NATO allies in terms of modern military forces.

Their forces and those of the other Warsaw Pact members were then numerically superior, but inferior in the quality of their equipment. Accordingly, the US and our NATO allies enjoyed a substantial qualitative superiority. The modernization program upon which we embarked in 1970 was designed to exploit our technology and use it to field systems which would continue that margin

of qualitative superiority. That program has gone well. We have developed modern systems and are now acquiring them and modernizing our force.

As we proceeded with our modernization program, the Soviets moved much more aggressively than any of our estimates predicted. They increased their numerical advantage more than expected and, more alarmingly, have reduced, and in some cases reversed, the qualitative advantage we held. In Europe this means that Soviet and Warsaw Pact forces have fielded a modern motorized and armored force, a dense multi-system air defense, modern attack aircraft and helicopters, and a growing conventional tactical missile threat. By many of the measures which we have used to compare our forces, we have indeed lost ground. Consequently, the uncertainties for the Soviets in conducting a conventional campaign in Europe have been reduced and so has the deterrent posture of the US and NATO forces.

At the same time the military situation in the Third World has worsened. Soviet military power and influence have been increasingly projected there. In Southeast Asia, in particular, Soviet military equipment has been used to establish large and modern mechanized and armored forces. Developments in Africa and Latin America also confront us with a militarized Third World which is unstable.

Where have these developments placed us? While we have been modernizing, the Soviets have been increasing their numerical advantage and eliminating the qualitative gap. However, as these developments emerged, our military planners recognized the need to meet them, first, by developing doctrine for the employment of our new weapons and, second, by devising new organizations for our combat forces to meet our increasing worldwide commitments.

In 1972, the Army's primary mobility and firepower weapons systems were rapidly approaching obsolescence. A clear and immediate requirement to modernize these systems was evident. The Army leadership established a program to focus technology and development efforts on systems identified as being most crucial to execution of the Service's combat mission.

Five major development efforts emerged, termed the "Big Five." These systems, which will provide the mobility and firepower necessary to support the Army until the year 2000, are now being produced and fielded. They are the M1 Abrams main battle tank, M2 and M3 Bradley fighting vehicles, AH-64 Apache attack helicopter, UH-60 Black Hawk helicopter and the Patriot surface-to-air missile system.

The success of the Big Five programs was attributed to the focus established by the Army leadership, the Congress and defense contractors. Today, the requirement to distribute scarce resources to achieve maximum capability is more challenging than ever before. In 1972, our doctrine was oriented toward heavy forces; today we must have the capability to realistically engage threats across the full spectrum of warfare, from terrorism to the nuclear battlefield. The rapid advancement of technology, coupled with its broad application to weapons systems, makes it imperative to define requirements, develop systems and field hardware in the shortest time possible.

Recently, the Army Staff concluded a short, intense study to identify follow-on initiatives to the Big Five. From that study, a concept has been established to guide development and fielding of weapons between now and the year 2000.

The concept centers on "key operational capabilities," or those warfighting capabilities the Army must have to fight and win on any battlefield. The key operational capabilities provide a means

of identifying the necessary systems, programs and technologies to ensure that priority Army research, development and acquisition efforts are supported in the annual program, planning, budgeting and execution cycles. The key operational capabilities are identified as: reconnaissance, surveillance and target acquisition (RSTA); command, control and communications (C3); battlefield lethality; battlefield sustainment and soldier and unit performance enhancement. Other capabilities such as strategic and intratheater lift were recognized as being critical, but are less affected by Army research, development and acquisition activities.

The concept of key operational capabilities capitalizes on those technologies where the United States has an advantage, for example, microchip technology and biotechnology. This competitive edge provides the potential to achieve a significant improvement in war-fighting capabilities, which will offset quantitative deficiencies.

The potential for improvement extends across the entire spectrum of fighting capabilities, including the areas of battlefield synchronization and deep-attack capability. Such an improvement will not only change the nature of land warfare but will also shape it in U.S. terms as opposed to those dictated by a potential enemy.

AirLand Battle is a major advance in doctrine. It addresses the battle activity in the rear, close-in, and deep areas as concurrent, synchronized operations. This doctrinal development is particularly bold in its concept for deep attack; that is, projecting combat power deep to attack the second and third echelons of the enemy force. This aspect of AirLand Battle is generally described as producing delay and disruption of these echelons, but by doing this, it does much more. Deep attack in AirLand Battle places the whole concept of Soviet campaign operations at risk. Thus, as we implement this doctrine, we will greatly increase the margin of uncertainty for the Soviets regarding the outcome of any conventional campaign and, therefore, restore the deterrent posture of our conventional forces.

It is important to note that this is a joint doctrine which provides the framework within which the Army and Air Force coordinate plans for R&D programs and for operations.

AirLand Battle is already being implemented with the forces and equipment now in the field. However, the full development of the power of this concept depends on the exploitation of emerging technologies in sensors to see deep, in smart munitions to strike deep, and in data processing and telecommunications to rapidly manage these resources. Our scientific and technology base in the US uniquely positions us to do this and, thus, to establish a major advantage over our adversaries in employing weapons on a modern battlefield.

Since the full capability of AirLand Battle doctrine will be underwritten by science and technology, it is particularly important that we sustain an aggressive R&D program to support it. To do less would be to ignore a major advantage we have in applying science and technology to leverage our combat power. To do less would also risk assuring the success of the Soviet strategy to develop superiority by fielding larger forces and matching or exceeding our weapons in quality.

Our plans for improving the capability of our light forces also require an aggressive applied technology program. The reorganization of these forces under the Army of Excellence program will provide for greatly increased deployability. These forces, however, need greater firepower to meet modern mechanized and armored threats.

A major task of the Army is to achieve synchronization of the AirLand Battle. It is expected

that the potential enemy will outnumber us in weapons and in manpower. Our advantage must be gained by bringing to fruition the nation's capability in high technology, so that we may field the systems necessary to control the battlefield and offset enemy numerical superiority.

Another major task is to field a deep-attack capability for heavy and light forces. We must be able to detect, identify and attack enemy follow-on forces, command and control centers, and logistics operations. With their disruption, we can be successful; without it, we cannot.

One must never forget that the most crucial battle will be fought at the forward line of troops where the infantry and armor soldiers, with the support of all other arms, ultimately win or lose the battle. Hence, we continue to place geat emphasis on the weapon systems that are key to this battle.

The Army must, of course, continue to define and refine joint service operational capabilities. We fight as a team with the Air Force, Navy and Marine Corps and must coordinate our RDA programs with theirs.

The key operational capabilities provide the basis for the development of systems and programs to be emphasized in the 15-year period ahead. Specifically, each system in development must clearly demonstrate that its presence will significantly enhance the warfighting capabilities of the Army and that it will go into production before the year 2000.

The soldier is the ultimate recipient of all of our research, development and acquisition efforts. Today's soldiers are exceptional. They are well qualified, physically and mentally toughened by their training and led by competent and caring leaders at all levels.

Proper soldier-machine interface is receiving increased emphasis in the design of all our equipment. We continually encourage weapons makers and Army program managers to pay more attention to soldier-machine interface problems as they lay out a new system in the concept formulation stage. The soldier must be "in the loop." We ensure that proper attention is paid to the manpower function and requirement in relation to the hardware to make the system far more effective in battle.

The capabilities of our soldiers will be a determining factor in system design. With fierce competition for top-quality recruits facing the Army in the future, both qualitative and quantitative personnel demands will become critical. Weapons and equipment must be designed to fit the soldier and his fighting environment. Program managers and laboratory directors are insuring that the man-machine interface effort makes the machine fit the soldier. Proper equipment design can reduce the soldier's work load in the high stress combat environment.

Emphasis on soldier performance enhancements is producing increasingly improved support items for the individual soldier. New clothing and equipment technologies mean increased survivability for the smaller and more lethal force of the future. These include research in chemical fibers and fabrics to optimize flame resistance and relief of heat stress; evaluation of new experimental fabrics for ballistic protection; development of improved chemical protective clothing and equipment systems; improved desert camouflage and infrared signature suppression and lightweight cold weather protection. Microclimatic conditioning units for vehicle crews will be fielded in the M1A1 Abrams tanks.

The M1 tank is being brought to a new level of capability with the fielding of the new M1A1

model and plans for a future package of improvements for that superb tank. The M1A1 improvement program is aimed at both improved effectiveness and operational and sustainment (O&S) cost savings. The effectiveness improvements are:

- An independent thermal-imaging night viewer for the tank commander.
- Improved commander's weapon station.
- Improved range finder.
- Better survivability.
- Driver's thermal viewer.
- A battlefield management system.

The research, development, test and evaluation (RDT&E) began in fiscal year 1985, and introduction to tank production is scheduled for August 1988 or sooner, if possible.

Thinking beyond the M1-series tanks and M2-M3 fighting vehicles, we are developing a concept for a family of future armored combat vehicles. Scheduled for a late 1980s research and development start, this program will give the Army significant improvement in force effectiveness by exploiting high-technology improvements. The combat vehicle family will support our needs well beyond the year 2000.

Another example of the emphasis on increased lethality is in the munitions area. Technology is dramatically altering the approach to fire support. Massed fires are becoming precision fires. Advanced munitions will be directed at targets rather than at points in space. Their lethality will result from having a self-contained capability to select targets and home in on them.

These "smart" munitions represent the most significant change in conventional indirect-fire support in the Army's history. Microelectronic technology makes it possible to build into missiles and projectiles the ability to detect targets with a variety of advanced sensors. This technology will significantly reduce logistics and manpower requirements while increasing lethality.

The Army's current force structure initiatives reflect changing strategic concerns. As the focus shifted from Vietnam to the potential armored and mechanized battlefields of NATO Europe, force structure became heavier to counter the Soviet threat. Therefore, we applied technologies to support a heavy mechanized force; but in light of the current need for rapid deployment, we are seeking ways to reduce the average weight and size of equipment. Exciting advances in this process have produced a new nonmetallic composite armor, which has been tested on the M2 and M3 Bradley fighting vehicles. This plastic armor, reinforced with E-glass and S-2 fibers, has been demonstrated on a Bradley turret, with a weight savings of 15 to 20 percent. An unanticipated finding is that the glass laminate is a better damper of sound and vibration from the main gun than aluminum.

Trends in the force at large also reflect down-sizing. For example, the advanced field artillery tactical data system (AFATDS) now in development will be considerably better and smaller than its predecessor "Tacfire". In addition, the logistics community will replace large computers with smaller and easily portable models.

The Army is emphasizing improvement in ammunition logistics. The new initiatives include improved plastic packaging for current and future ammunition that will be lighter, less bulky, easier to handle, cheaper and will be easier to decontaminate, by possessing better nuclear, biological and chemical protection characteristics. A technology base program has been established for improvement of ammunition packaging and handling.

The demand for logistical support can be reduced by implementing the down-sizing and weight reduction initiatives in our "Army of Excellence" force structure goals. One of the driving factors in down-sizing the force is to make it more supportable and deployable; however, the anticipation of greatly accelerated consumption rates of supplies and attrition of equipment have made the challenge of improving our support capability even tougher.

The Army has recently established a number of "battlefield sustainment objectives." They reflect the complex nature of sustainment issues, but are ultimately concerned with reducing the demand for logistical support. The objectives are:

- Balance prepositioned war reserve stocks against requirements.
- Significantly reduce maintenance requirements.
- Eliminate unneeded weight and bulk.
- Reduce the money and manpower demands of the logistics system.
- Field survivable logistics support systems.
- Create a capability to manage mass casualties.
- Protect industrial-base resources.

Industrial-base preparedness is a matter of great concern. Wartime sustainability requires funding support for the necessary mobilization manufacturing capacity in U.S. industry. The objective of this program is to satisfy materiel demands at a prescribed level within one year of the decision to expand production. These plans involve billions of dollars and have not been well supported in the past. We must focus on this in the future, within the constraints of a limited budget.

We must maintain a limited number of government-owned manufacturing facilities which are either government or contractor operated. These plants manufacture major items, large-caliber munitions and special propellants that. Funding to support a "surge" production capability for selected, highly critical items is essential.

The Army is not standing still. Force modernization is real and must be completed. While we are working at improving our force through acquisition of new systems we must diligently conduct research and development for the future or we will place ourselves in the dilemma that faced us following the Vietnam conflict. To control this monumental task requires that we all work together to provide our most important asset—the soldier—the equipment needed to perform in a most effective manner. The RDA community is totally dedicated to that effort.

# TECHNOLOGY BASE

Unrelenting quantitative and qualitative advances by our potential adversaries underscore the necessity for realistic, comprehensive, and innovative long range RDA planning for our Army of Excellence. Technology and telesis (progress that is intelligently planned and directed) are more important now than ever. During the past year, we have continued to improve our long range RDA plan, which is the starting point for our budget and 5-year plan preparation, and the roadmap for our technology base investment strategy. Our plan is built upon realistic threat forecasts, AirLand Battle Doctrine, frank assessment of our deficiencies as identified by the Battlefield Development Plan and Mission Area Analysis process and solid technology forecasting. The resultant technology base investment strategy matures technologies needed by future systems, exploits our current technological advantages, accelerates high leverage technologies and nurtures emerging technologies. Our hierarchy of RDA plans is extensive, comprehensive, consistent, and ranges from the HQ DA Long Range RDA Plan to the Mission Area Materiel Plans of our major development commands to the science and technology plans of our laboratories.

This year's FY88-2002 long range RDA plan supports achievement of five Key Operational Capabilities which are prerequisites to victory on the future battlefield. Capitalizing on those high leverage and emerging technologies for which we have an advantage, the concept of the Key Operational Capabilities permits us to realize the full potential of our nations technology capability.

The technology base is maturing technologies in time for future systems development and product improvements of current systems to eliminate deficiencies and seize opportunities. One example is the Light Helicopter Family (LHX) program. Army laboratories working with the other Services, NASA and industry are maturing the technologies required for LHX. A FY88 full scale development start for LHX would not be possible without these efforts. Examples include: advanced composite airframe structures; very high speed integrated circuit technology insertion; crew workload AirLand and man-machine interface simulation; advanced digital-optical flight control system, sensor fusion: automatic target recognition: survivability demonstrations; and expert systems for diagnostics. This technology is important to several other future systems such as the Armored Family of Vehicles currently in concept formulation. The LHX will be the first rotorcraft designed from the outset with the aid of extensive engineering simulation, mission simulation and wind tunnel testing.

The Army technology base continues to integrate, focus and apply high leverage technologies for each of the Key Operational Capabilities.

• Reconnaissance, Surveillance and Target Acquisition (RSTA)—Very intelligent surveillance and target acquisition technologies will permit the fusion of data from multiple sensors to provide information needed by the Army commanders on the fluid, complex battlefield of the future. Near-realtime presentation of ground based and airborne radar, optical and human intelligence will

provide the needed increases in lethality and survivability. Millimeter wave technology is being pursued to permit a sensor to see and terminal homing missiles and artillery rounds to engage targets through battlefield smoke, fog and dust. Advanced visible and infrared technology is making a major contribution to our ability to passively detect and identify targets at night and under adverse weather conditions. This past year we demonstrated the first uncooled sensor array for night vision. AirLand battlefield environment tactical decision aids will provide information on terrain, weather and battle-induced contaminants and intelligence regarding the effectiveness of friendly or threat weapon systems and operations.

• Command, Control and Communications (C3)– Distributed C3 technologies and networks will enhance communications and the reliable distribution of information to all levels of command. Digital burst transmission techniques, millimeter wave and higher frequency spectra, and fiber-optics are being pursued to improve jam and intercept resistance and continual information transmission.

• Battlefield Lethality—Self-contained munitions technology will allow munitions after launch to autonomously search, acquire, select and home in on hostile targets. Benefits include increased kills per missile or round fired, greater survivability for the launch vehicle or battery and lower cost per kill. Advances in fiber-optics, infrared, electro-optical, radar, fuse, warhead and delivery system technologies are being pursued. Our Armament Enhancement Initiative Program is focusing technology efforts on defeating the armor threat of the 1980s. Recent accomplishments in battlefield lethality include the successful flight demonstration of the ground launched fiber-optic guided missile (FOG-M).

• Battlefield Sustainment- Logistics R&D is being expanded to improve weapon systems reliability and maintainability, reduce consumption, reduce manpower intensity and reduce operating and supportcost. Expert system technology for helicopter diagnostics and condition monitoring is being demonstrated to reduce the number of inspections and scheduled maintenance tasks by monitoring flight data. The cognitive skills of the expert maintainers and diagnosticians are instantly made available to the lesser experienced maintainer. Our food technology program has demonstrated a light weight mobile combat feeding system for the soldier in the field that provides high nutrition, prepackaged, labor-free hot meals for the unit on the move.

• Soldier and Unit Performance Enhancement- Proper soldier-machine interface is receiving increased emphasis not only in the design and development of our equipment, but also during the concept formulation and technology development stages. Soldier-machine interface technologies will improve training, expand individual capabilities and make it easier to operate sophisticated equipment. Robotics, expert systems and artificial intelligence will reduce the workload, enhance the performance of human operators and reduce the number of required operators. Computer generated imagery and display technology for more realistic mission simulators and embedded training technology are but two of the advanced technologies contributing to rapid training advancements.

Our 6.1 basic research program supports both theoretical and experimental research by Army laboratories, industrial laboratories and over 200 universities. These universities and labs are the birthplace of the emerging, high leverage technologies of the future. This year's budget includes the University Research Initiative (URI) for ten scientific areas vital to our Army of Excellence. This is part of a DoD-wide competitive program initiated in FY86 with U.S. universities. The successes of our Centers of Excellence for Rotary-Wing Aircraft Technology at Georgia Institute

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**of Technology, University of Maryland and Rensselaer Polytechnical Institute prove the mutual benefits of this program to the Army, industry, universities and the nation. The URI program stimulates fundamental research vital to the Army, provides a valuable pool of high technology expertise, speeds the infusion of emerging technologies from academia to industry, promotes a stronger university/Army laboratory interface and produces scientists and engineers educated in disciplines critical to the Army. The URI addresses ten vital technology areas: manufacturing science; reliability and maintainability technology; electro-optics; signal processing and image understanding; advanced propulsion systems; geosciences; fast reaction kinetics; intelligent control systems; high frequency microelectronics; ultra dynamic performance materials; biosystems and biotechnology and advanced construction technology.**

9

# MEDICAL RESEARCH

Together with modern battlefield weapons systems, the soldier must be considered a "System" and, as the operator, is the most vulnerable and critical component in the array of battlefield systems. The Army medical research and development program is geared to address performance degradation factors that could make this system inoperable or cause it to operate at reduced efficiency due to physical, psychological, or disease-related stresses in a variety of climates and hostile environments, both in peacetime and during periods of hostilities.

Many of the normal, daily hazards to the soldier come from sources such as blast overpressure from artillery, combustion fumes from explosions, and radiation from laser, microwave, and radar systems. Army Medical Research addresses these environmental and occupational hazards.

Advances are also being made to aid the soldier in dealing with natural stresses. These include heat, cold, altitude, sleep deprivation, exhaustion, and the psychological strain of the battlefield. Our personnel are more likely to become casualties from infectious diseases that have decimated military forces during past wars than from any manmade weapon system. Exploiting high payoff technological opportunities in development of drugs, vaccines, and devices for the diagnosis, prevention and treatment of communicable diseases is crucial for success in this area. Monoclonal antibody productions, genetic engineering, novel drug delivery systems, immune enhancement and biomicrosensor development are being actively pursued.

Recent advances in biotechnology are being utilized to speed the process of vaccine development. A notable accomplishment in this area was the development of a vaccine against falciparum malaria. This strategy is being applied to develop vaccines against other parasitic diseases to include African sleeping sickness and leishmaniasis. Recombinant DNA and monoclonal antibody techniques are being used to prepare diagnostic reagents field kits for use in rapid identification of BW agents and natural diseases in the field.

Ribavirin, an anti-viral drug was found to have a curative effect against Korean and Argentinian hemorrhagic fever viruses. A recombinant Rift Valley fever vaccine was found to be very effective in animals.

During periods of hostilities, the soldier may be incapacitated or at reduced efficiency due to the effects of chemical, nuclear, or biological weapons. In support of the soldier on the modern battlefield, new techniques in disease prevention, self-treatment, patient management, resuscitation, and decontamination have been and are being developed. The cyanide antidotes, sodium nitrite and sodium thiosulfate were repackaged and included into the chemical treatment set at battalion aid stations. A prototype vital signs and heart rate monitor has been developed. we have completed operational testing on a prototype patient wrap. Development was completed on a prototype

individual soldier resuscitator. We also initiated a soldier performance battery testing with pyridostigmine.

Improved treatment of combat casualties requires earlier diagnosis and treatment of hypovolemic shock. In addition to improved resuscitative fluids, drugs that may "buy time" until adequate volume replacement can be effected are under investigation.

Research aimed at reducing mortality and morbidity due to head missile wounds is a high priority. Improved management of burn wounds is sought through improved dressings, skin substitutes, and epithelial growth systems.

Combat medical materiel items being developed include field production of oxygen and medical grade IV water, field medical refrigerator, heated patient liner for the transportation of casualties, and wheeled litter carrier.

Research in the area of combat dentistry currently includes the following major efforts: the development of synthetic, biodegradable implant materials to replace missing facial bone segments that will accelerate wound healing and simplify final surgical reconstruction; completed advanced development and field testing of a computer-aided post-mortem identification (CAPMI) system; sucessfully laboratory tested a second prototype light-weight hand-held field dental x-ray.

Research in stresses to the soldier-operator produced by materiel systems, battlefield environments, and natural environmental extremes has resulted in a data base and performance criteria for acute mountain sickness. We also conducted field testing of the Combat Feeding System, the largest test ever undertaken of a military field feeding system.

Anticipated FY87 efforts include: field testing vaccines such as malaria, Korean and Argentinian hemorrhagic fever viruses, Rift Valley fever virus, salmonella-shigella (dysentery) vaccine,and anti-malarial drugs. We plan to test prototypes of on-site oxygen generation systems, resusciatative fluid production systems and a high capacity x-ray system. Other efforts will include work on: pharmacological intervention of soldier performance to include jet lag, fatigue and sleep reversal. Futher efforts include: work/rest cycle, family/individual/soldier cohesion, development of artificial skin and a blood preservation system.

Furthermore the following are also planned for FY87: field testing of CAPMI; clinical trials of wound dressings; preparation of sustained time release microencapsulated antibiotics for prevention of wound infection; oral pyridostigmine; production of a patient wrap; a full scale production of chemical warfare agent decontamination resin; and development of a second generation nerve agent pre-treatment and antidotes.

These accomplishments are merely a few of the highlights of an extremely complex and broad research effort encompassing all aspects ofpotential hazards to the soldier, the crucial "system" on the technologically complex modern battlefield.

## STRATEGIC DEFENSE

Since the 23 March 1983, speech by the President in which he announced the goal of eliminating the threat posed by ballistic missiles, a program called the Strategic Defense Initiative (SDI) has been established. The SDI, under the centralized management of the Strategic Defense Initiative Organization (SDIO), Office of the Secretary of Defense, is charged with pursuing technologies for defense against ballistic missiles. Emphasis in the program is being given to non-nuclear weapons for defense. The funds for this critical research program are controlled by SDIO and allocated to the Services for execution on a task basis. The Army portion of the SDI has been in being for more than 25 years and received renewed interest and direction with the formation of the U.S. Army Strategic Defense Command (USASDC) on 1 July 1985. The Commanding General, USASDC, acts as the single point of contact in the Army for SDI matters.

After the Congressionally directed termination of the Army-developed BMD SAFEGUARD system in 1975, the U.S. has not had a deployed BMD SYSTEM. However, a continuing R&D program in BMD technology verification and functional experiments has evolved. It promises new technologies and refined system concepts to provide reduced risk and technically advanced options for consideration for future full-scale development. The potential for highly effective defensive systems has never been greater. New systems concepts possess potential for countering attacking ballistic missiles in all phases of their trajectories. Progress has been dramatic in expanding and advancing the technology base from which these future BMD systems will evolve. As a result, the program is in a position to make substantial contributions to the Strategic Defense Initiative technology efforts.

The Army strategic defense program has been conducting R&D aimed at increasing the capabilities and effectiveness of defensive systems for over 25 years. Because of these efforts, the Army has established a highly experienced BMD organization with an extensive technical data base. The Army is therefore uniquely capable to support the Strategic Defense Initiative through early demonstrations of defense capabilities.

Major program thrusts are aimed at demonstrating system and subsystem concepts and developing the mature technologies necessary to support them. Significant effort will be put into defense definition, experiments of aircraft mounted optical sensor adjuncts, terminal imaging radar, advanced radar discrimination, and nonnuclear kill interceptors. Nonnuclear Kill (NNK) mechanisms both within the atmosphere (Endoatmospheric NNK) and outside the earth's atmosphere (Exoatmospheric NNK) and outside the earth's atmosphere (ExoatmosphericNNK) are the major thrust of the program. In addition, experiments will proceed on a terminal defense radar, command, control communication/battle management (C3/BM) system, and data processor. Advanced technology work, to expand the base from which new systems will evolve, will continue

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on a broad front, including research on directed energy and kinetic energy weapon technologies, advanced sensors, battle management, data processing and discrimination missiles.

Systems concepts being examined include endoatmospheric and exoatmospheric defenses. The integration of these into a multi-tiered defense in depth provides a logical and evolutionary growth path for BMD to a wide range of future options to counter a continued buildup of the Soviet threat in both quantity and quality. These options provide the flexibility required for the various potential BMD missions. For example, a defense in depth could provide protection to critical military and industrial installations and other high value targets. By pursuing a broadly based effort, the BMD program maintains the flexibility to provide defense options for many different applications and thus support the President's goal of eliminating the threat posed by ballistic missiles.

The BMD program also operates the Kwajalein Missile Range (KMR) as a national range. The simultaneous use of KMR for both strategic offensive and defensive program testing provides a unique opportunity to collect realistic data vital to both efforts. The ability of the BMD program to observe and analyze development and operational ICBM firings allows cost savings in the tens of millions of dollars yearly. Kwajalein is the only range in the free world that can accommodate full-scale ICBM tests and provide sophisticated data collection for the terminal and midcourse portions of the trajectory. KMR is a unique national resource, utilized by the Services, NASA and other government agencies.

The Army Strategic Defense Program, through its broadly-based R&D efforts, seeks to develop multi-tiered defense capabilities and conductearly demonstrations of critical defense components. The development of nonnuclear kill systems will continue to receive high priority. The BMD program, by building on the existing infrastructure and emphasizinge volutionary development, is able to accomplish these goals and offer a wide range of options for the defense of the country.

# CLOSE COMBAT

The Close Combat mission area relates to weapons and equipment which are used to bring direct, line-of-sight fire upon the enemy. The soldiers who fill this role are often referred to as "frontline troops" and their job is to close with and destroy the enemy. To do so, they must be well led, well trained, and provided with the equipment that will give them an edge over their adversaries. The next several paragraphs will describe those close combat equipment systems for which we are requesting funds in the FY87 budget.

*Frontline troops require close combat systems*

The main offensive and defensive ground weapon of both the US and Soviet ground armies is the tank. In a combined arms role, tanks can dominate the battlefield, spearheading the offensive, killing other tanks, devastating "soft" targets, and driving through defensive positions with massive momentum. Equally adept on the defensive, the tank provides a ground commander with unequalled capability to counter enemy offensive ground weapon systems. The tank is essential to success on the modern battlefield. The Army's main battle tank, the Abrams, is the most powerful, mobile, and survivable combat vehicle we have ever fielded, and we believe that it can outperform any other tank on the battlefield.

*The M1 Abrams—Main power of the battlefield*

*M1 Abrams*

*Agility*

The agility of a tank is a major element in determining its effectiveness and survivability on the battlefield. A 1500-horsepower turbine engine supplies the Abrams with double the power of its diesel-powered predecessor, the M60. Coupled with an improved suspension system, its agility is unsurpassed by any tank in the world today. Its stabilized sighting system ensures that speed is combined with accurate firepower.

*Accuracy*

Tankers are able to routinely hit 5-foot targets over a mile away while moving rapidly cross-country. This kind of shoot-on-the-move accuracy is made possible by design features of the fire control and improved suspension systems. The gunner puts his sight on the target and finds the range using a laser rangefinder; a computer automatically determines the ballistic data and adjusts the lay of the main gun; the gunner need only squeeze the trigger to hit the target.

*Shooting-On-The-Move*

*Survivability*

The future battlefield will be thick with antitank weapons. Therefore, the Abrams is protected by advanced armor. This, plus its low silhouette and agility, increases its survivability on the battlefield. If the tank is penetrated, a number of revolutionary safety features greatly enhance the survivability of the crew and the vehicle. These include an automatic fire detection and

extinguishing system and armored compartments that separate the fuel tanks and main gun ammunition from the crew. The Abrams' passive thermal imaging system allows location of targets at night and through dust, haze, fog, and smoke without disclosing the tank's position. Initial delivery of the product improved M1 the M1A1s began in August 1985. The M1A1 incorporates the German-designed, US-manufactured 120mm smoothbore gun, improved NBC protection system and improved armor. The addition of the 120mm gun will insure that US tanks can keep pace with improvements in Soviet armor expected in the late 1980's and beyond. The major advantages of the 120mm gun system are greater kill capability and growth potential to meet advanced armor threats.

*A proven performer*

The soldiers' appraisal of the M1 can be summed up in one word—winner! They found the M1 Abrams easier to maintain than the M60 tank and able to shoot more accurately while moving cross-country at high speed. The Army has fielded 32 battalion equivalents. A North Carolina National Guard Armored Battalion (a 2d Armored Division round-out battalion) has received its tanks underscoring our commitment to modernize the reserve components. The FY87 budget provides for 840 M1A1 Abrams Tanks. We have produced 3,656 Abrams tanks as of 31 December 1985.

*M60A3—Still a capable tank*

The M60A3, a product improved M60 tank, is still a formidable tank. It is a quality tank that will continue to see service into the 1990's because we cannot afford to replace our entire fleet of M60 series tanks with the Abrams. The M60A3 model incorporates a laser rangefinder and a ballistic computer for accurate ranging and improved fire control solutions, and a thermal sight that gives the crew an improved capability to detect targets in darkness and on an obscured battlefield. In FY87 upgrade of the M60A3 will continue with the incorporation of applique armor and an automatic fire supression system to improve survivability.

*M60A3*

*Bradley Fighting Vehicle*

*The Bradley Fighting Vehicles*

The history of modern warfare has vividly demonstrated that tanks are critical to success on the battle-field. Operating independently, however, they are vulnerable to antitank fires from enemy infantry. Therefore, mechanized infantry must be combined with tanks to assure a blend of maneuver forces that will provide the flexibility necessary to defeat any threat. The Bradley Fighting Vehicle is an ideal partner for the Abrams. This vehicle has two configurations, the Infantry Fighting Vehicle (IFV) and the Cavalry Fighting Vehicle (CFV).

The Bradley Fighting Vehicle provides vastly improved cross-country mobility, firepower, and armored protection to the mechanized infantry squad. In intense combat situations, the tank-infantry force must be supported on the move by continuousand accurate fire. The primary weapon of the IFV is a stabilized, dual-fed 25mm automatic cannon. The commander

or gunner can instantly select either high-explosive or armor-piercing rounds. The high-explosive round can destroy unarmored ground targets out to 2500 meters, while the armor-piercing rounds are capable of penetrating and defeating the Soviet BMP. The two-man turret also has a two-tube TOW missile launcher and a 7.62mm coaxial machinegun. The TOW gives each squad the capability to engage enemy tanks at long range from overwatch (protected) positions.

The IFV has vision blocks, through which members of the squad it transports can view the battlefield and direct fire from their modified M-16 rifles through individual firing ports. This permits continuous observation of, and contact with, the enemy while on the move. Once outside the vehicle, troops can move toward the objective supported by a high volume of firepower from the vehicle's other weapons.

The CFV is identical to the IFV except for minor modifications for crew size and equipment. The CFV carries a five-man scout squad and provides the cross-country mobility and mounted firepower necessary for armored cavalry and battalion scout squads to carry out reconnaissance, security, and economy-of-force operations.

*M2-3 Bradley Fighting Vehicle*

Both the IFV and CFV have an inherent swimming capability and are air transportable in either the C-141 or C-5A aircraft. These fighting vehicles match the highway and cross-country mobility of the Abrams tank. Furthermore, they provide soldiers significant protection from enemy small caliber weapons, heavy machine guns, artillery airbursts and antipersonnel mines. A thermal night sight insures that this potent weapon system maintains its capability during night operations. No fighting vehicle available in the world today matches the all-around capabilities provided by the Bradley.



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*Bradley: Demonstrated all-around capabilities*

The first Bradley production vehicle was delivered to the Army in May 1981. Today, we are producing the Bradley at a rate in excess of 50 vehicles per month. The first mechanized infantrybattalion was equipped in March 1983 at Fort Hood, Texas, and the first European battalion was equipped in September 1983. The North Carolina National Guard has also received six CFV's. As of 31 January 1986, 2142 Bradleys have been accepted by the Army. Seventeen battalion equivalents have been fielded. The FY87 budget supports the production of 870 Bradley vehicles in the BFVS-A1 configuration. This vehicle includes the TOW-2 system, a tank killing armament, which allows the Bradley to shoot through obscurants while counteracting jamming.

Like the Abrams tank, the Bradley is a winner in the view of the soldiers who use it. It provides them a capability they have never had on the battlefield before. The Bradley is a superb fighting system today which can be made even better by product improving it like we do all our systems. The Army is currently developing a series of survivability improvements to make it even better.

The M113 family of vehicles continues to serve the Army in a variety of combat, combat support, and combat service support roles. The Army has begun survivability modifications to enhance the capability of this fleet into the 1990's. Improvements include spall suppression liners which decrease the spray of shrapnel in the event of vehicle penetration. Additional improvements are armored external fuel tanks, improvements to the power train and provisions for add-on armor kits to increase protection levels for the crew. The powertrain improvements increase reliability and maintainability while providing the power increase needed to assure adequate agility and mobility on the battlefield.

*M113 Armored Personnel Carrier*

*M113*

Another variant of the M113 vehicle family is the M577 Command Post Vehicle which provides command and control facilities for both forward maneuver and support forces. It features a raised top deck section that

permits stand-up work within the carrier and an auxillary power unit to permit operation with the main engine shut down. The FY87 budget will procure 300 new M577'sagainst existing shortages.

Attack helicopters continue to be a key element of our Army's combat capability. They provide our forces with a highly mobile, long range, day/night lethal antiarmor fire capability, coupled with the anti-materiel, antipersonnel effect of cannon and 2.75-inch rockets. The attack helicopter was first used in combat in Southeast Asia where it proved to be a great asset to our light infantry forces.

*Attack Helicopter's inherent mobility*

Because of its inherent mobility, attack helicopters will play a major role in any situation that requires our forces to react quickly. They can strategically deploy to reinforce Europe or respond to other contingency requirements; they can fly rapidly across a wide front to areas that cannot be reached easily by ground mobile forces and they provide a significant advantage in target-rich environments where exploitation is feasible. In Europe, a ground attack on our forces will be spearheaded by masses of armored vehicles. Soviet doctrine stresses building overwhelming momentum with blitzkrieg-like tactics. Frontages mandate that we concentrate on their main avenue of approach and quickly counter their armored thrusts. No other weapon system offers the combination of high movement rates, freedom of the tyranny of terrain, and long-range point target destruction capability, around the clock, even during adverse weather conditions like that of the attack helicopter.

*AH-64 Attack Helicopter*

The large number of attack helicopters that the Soviets have fielded in recent years shows that their leaders share our belief that the attack helicopter will play a vital role in any future land battle. The importance of

attack helicopters, and the recognition of Cobra/TOW performance limitations, led to the development and procurement of the Apache Attack Helicopter (AH-64). The Apache represents a significant increase in performance, firepower, and survivability when compared with its predecessor—the AH-1S Cobra. More important, the Apache provides the Army a mobile, lethal antitank capability that can be quickly deployed worldwide to areas of strategic concern. Apache's ability to operate worldwide over a broad spectrum of environments may be the difference between success or failure.

*Appache Attack Helicopter: An all-environment performer*

The powerful, two-engine Apache has been designed from the start to perform anywhere in the world under the most demanding conditions of altitude and climate. Its agility enables pilots to take advantage of the terrain, vegetation, and even buildings to avoid detection. A target acquisition/designation sight (TADS) and pilot night vision sensor (PNVS) enable the crew to navigate and attack in darkness, bad weather and on an obscured battlefield.

*Survivable*

Apache carries a formidable array of weaponry. The main armament is the Hellfire, a third-generation antiarmor missile. Apache's other armament includes the 30mm chain gun and Hydra 70 multi-purpose submunition rockets, which are lethal against a wide variety of targets and complement the antiarmor Hellfire missiles. The Apache's performance characteristics, coupled with survivability features such as armor protection, redundant controls, and electronic countermeasures equipment, make it one of the most survivable systems on the battlefield. A total of 67 Apaches have been delivered to the Army as of 31 December 1985. Training of pilots and maintenance personnel is underway to support fielding of the first Apache unit during the spring of 1986. The FY87 budget provides for procurement of 144 Apache helicopters at the economic rate of 12 per month.

*Cobra/TOW: Effective but limited*

Like the M60 series tank, the AH-1 Cobra helicopter has been continually upgraded to improve its operational capabilities, safety, and survivability. While these improvements will contribute to its effectiveness and survivability against armor, the Cobra is currently a daytime helicopter with limited aircraft performance capability when operating in a characteristically hot Middle Eastern environment. To correct the night-fighting shortfall, approximately 500 Cobras, will be modified with a Forward-Looking Infrared System (FLIR) to provide a night target engagement capability. The FY87 budget also funds other improvements and continues the Cobra Fleet Life Extension (C-FLEX) program. The C-FLEX program will enable the Cobra to continue in use beyond the year 2000.

*Scout Helicopters*

The use of scout helicopters to seek and select targets enables attack helicopters to conserve fuel and ordnance, and allows the commander to concentrate his antitank capability at critical points. Upon acquiring targets, the scouts position the attack helicopters, determine the distribution of fires, laser designate targets for the Hellfire missile, and coordinate artillery fires throughout the battle area. During the battle, scouts provide real-time battlefield information relating to the enemy situation and targets destroyed.

*Apache with Hellfire*

Additionally, the scout is a responsive system to refine intelligence from other sources and integrate all forms of firepower against the target.

The Army Helicopter Improvement Program (AHIP) upgrades part of the scout fleet into an improved observation helicopter. Engine performance and rotor improvements make the AHIP better able to operate on hot days and at high altitude. The mast- mounted sight incorporates a laser designator and a forward looking, infrared capability for night and adverse weather operations. This mast mounted sight allows the helicopter to remain masked behind the terrain with only the sight exposed. In addition to the employment of conventional artillery the AHIP has the capability of acquiring and designating targets for Copperhead and other Army or Air Force precision guided munitions.

*AH-1S Cobra/TOW*

*Army Helicopter Improvement Program*

The AHIP program, based upon modification of an existing light observation aircraft, complies with Congressional guidance and shows significant savings when compared with a new airframe development program. Advanced procurement funding in FY86 and procurement funds in FY87 will provide for the conversion of 48 aircraft in FY87.

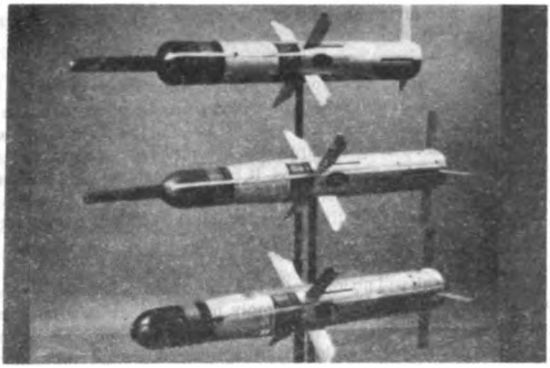
The TOW missile system, which is found on the AH-1S Cobra, the Bradley Vehicles, Improved TOW vehicles, the HMMWV, and with the dismounted infantry, is the most powerful antitank weapon used by ground units. This long-range (3750 meters) antiarmor system is a prime example of evolutionary development. First fielded in the late 1960's, the TOW has been improved to keep pace with the evolving Soviet tank threat. The latest improvement, designated TOW 2, will give the weapon an even more lethal 6-inch warhead, greater speed to reduce vulnerability, and improved guidance and electro-optical countermeasures for an obscured battlefield environment. Deliveries of TOW 2 began in 1983 and it was deployed to Europe in October 1984. Fielding is now complete in Europe, Korea and Panama. FY 87 funds will be used to procure TOW 2 missiles and launcher modifications.

*Army Helicopter Improvement Program*

The Swedish AT4, type classified M136 on 11 Sep 85, will replace the 1958 vintage M72 LAW. The AT4 provides the dismounted soldier with a lightweight, one shot munition that will enable him to effectively engage a variety of hard targets on the battlefield. This proliferable system will not require a dedicated gunner and will be issued to personnel as needed for mission accomplishment. The AT4 allows the soldier to engage and defeat targets at significantly greater ranges with a higher probability of kill than the current M72A3 LAW. The weapon is also being procured by the Marine Corps and the Navy.

*Squad Automatic Weapon*

The Squad Automatic Weapon (SAW) is a lightweight, manportable weapon capable of delivering a heavy volume of effective fire up to a range of 800 meters. It provides increased range, volume of fire, and better penetration than the M16A1 rifle which it replaces as the squad automatic



*TOW-2, Improved TOW, Basic TOW (Top to bottom)*

*Squad Automatic Weapon*

weapon. The fielding of this weapon will provide a significant increase in overall squad firepower.

**Mortars**

The mortar, although an indirect fire weapon, is included in the close combat mission area since it is used by forward combat units. The Army is replacing the present 81mm mortars with an improved 81mm mortar which incorporates a British manufactured mortar barrel and bipod mount and a US base plate and sight. It will fire an improved high-explosive round that will accommodate a multioption fuze and achieve extended range, increased accuracy, and higher lethality. Improved smoke and illumination projectiles are also under development. The FY87 request is for 450 systems. The Army will also replace the aged 4.2 inch mortars with the 120mm mortar. The 120mm mortars will be at the battalion level in mechanized, armored and

motorized divisions. First unit equipped is expected to occur in 2nd quarter FY87.

*Mark 19*

The Mark 19 Mod 3, 40mm automatic grenade launcher fires antipersonnel and anti-light-armor grenades to a maximum effective range of 1800 meters. The MK19-3 will be used in the main battle area by infantry units, and by combat support and combat service support units to conduct rear area security missions. It replaces selected M2 (.50 caliber) and M60 (7.62mm) machineguns and will be mounted on ground mounts and on Army vehicles such as the High Mobility Multi-purpose Wheeled Vehicle (HMMWV).

*Night vision devices will allow battle operations in the dark*

Nightfall will no longer curtail battle activities. Because of advanced night vision devices, night will simply mean a slightly altered environment to soldiers in a future war. This is possible through the Army's use of two different types of night vision equipment: image intensifiers and forward looking infrared imagers. The latter is also referred to as "FLIR" or "thermal imaging".

*Systems incorporate thermal imaging for night activities*

Image intensifiers see in darkness by amplifying the dim starlight and moonlight reflected from an object. The image intensification devices are lightweight and provide excellent resolution while "seeing" in the dark. These devices are for the individual soldier as well as the wheeled and tracked combat vehicle. The AN/AVS-6 and AN/PVS-5 are night vision goggles for aviators and ground soldiers. The night vision device for the M16 and M60 machinegun is the AN/PVS-4 and the AN/TVS-5 is designed for the M2 (.50 cal) machinegun. The AN/VVS-2, Drivers Viewer, gives the tracked vehicle driver a greater mobility capability, while driving at night.

Another family of night vision devices is thermal imaging. By sensing the temperature difference between an object and its surroundings, these devices allow the soldier to "see" through darkness, smoke, haze, fog, and battlefield obscurants to recognize and identify targets. The Army systems incorporating thermal technology include a family of manportable systems consisting of the AN/TAS-4A, TOW Night Sight; AN/TAS-5, Dragon Night Tracker; and AN/TAS-6, Night Observation Device Long Range (NODLR). The M60A3 and M1 tanks incorporate the AN/VSG-2 and TIS, respectively, for gunner and commander use. The AH-64 APACHE attack helicopter uses the TADS/PNVS for fire control and pilot's night vision. The Bradley fighting vehicle also incorporates a FLIR in its integrated sight unit.

The Army's technology in night vision devices clearly leads that of Warsaw Pact Nations; however, the gap is closing. Therefore, we must continue technology efforts towards developing newer generation devices so that we can use darkness to our advantage on the future battlefield.

The Advanced Antitank Weapon System-Medium (AAWS-M) will be a manportable weapon employed by dismounted infantry at the platoon level to defeat current and future Soviet advanced armor. The system will provide

*Advanced Antitank Weapon System*

a high probability of kill in all realistic battlefield environments and in the presence of electronic/electro-optical countermeasures. The AAWS-M, which will replace the DRAGON system, will be developed to address the deficiencies of that system and will possess the growth potential to counter evolving armor threats. The AAWS-M will have a weight of no more than 45 pounds and an effective range of 2KM or more under day or night conditions. The tactical system will consist of a round (missile and throwaway launch tube) and a reusable command and launch unit (CLU). Increased gunner survivability will be a primary employment consideration. The system soft launch capability will enable firing from protected fighting positions; an all-environment sighting/surveillance capability coupled with extended range will enable the targets to be engaged earlier than DRAGON, thereby improving gunner survivability.

The next section on fire support mission area discusses how those frontline soldiers are supported.

## FIRE SUPPORT

The Fire Support mission area includes those systems that are used primarily to generate indirect firepower. The systems in this mission area include not only conventional, nuclear, and chemical firepower provided by cannons, rockets, and missile systems, but also the target acquisition and fire control elements integral to field artillery systems. This section will address the Army's longest range systems first and then will discuss direct support artillery weapons, fire control, target acquisition systems, and finally ammunition developments.

*Soviets attack in depth*

Soviet doctrine emphasizes the use of echelonment in depth. Warsaw Pact forces attack with successive waves of forces, massing as necessary through the use of mechanized armament systems to achieve victory. We must, therefore, be able to strike early and strike deep with great accuracy and massive firepower. We must also be capable of attacking enemy units up to the forward edge of our own troop positions with concentrated, accurate, and readily available firepower.

The Soviet's early use of their own artillery will make this task even more

*Pershing II*

difficult. Their doctrine stresses the use of concentrated artillery fire in coordination with blitzkrieg-like maneuver of troops. The Soviets greatly outnumber us in artillery and have the potential to strike our positions with massive amounts of indirect fires. To preclude this, our own field artillery must be able to neutralize their indirect fire systems through effective counterfire.

*Pershing II achieves surgical accuracy*

The Army's most powerful weapon is the Pershing II, which has more than twice the range of the existing Pershing Ia and far better accuracy. It employs radar area correlation to achieve its pinpoint accuracy. Radar "pictures" of the target area are put into the onboard missile computer prior to launch. As the reentry vehicle approaches the general target area, it takes its own radar "pictures" of the terrain, comparing them to the original. By making course corrections until the two pictures coincide, the missile can achieve surgical accuracy. This permits the use of a relatively small nuclear warhead that reduces collateral damage to the minimum. Pershing II is in production and completed deployment in December 1985.

*Lance strikes in depth*

The Lance missile system, which was fielded in the mid- 1970's, is our current system used to attack second-echelon enemy formations and for delivery of short-to-medium range nuclear fires. Lance can deliver a 1000 pound conventional warhead to a target located over 70 kilometers away. Enemy logistics facilities, air defense sites, and communications centers are prime targets for this warhead.

To improve the conventional capability provided by Lance and to eliminate many of its shortcomings, e.g., slow rate of fire, manpower intensity, limited range, etc., a follow-on program called the Army Tactical Missile System (ATACMS) is being pursued for the late 1980's/early 1990's fielding.

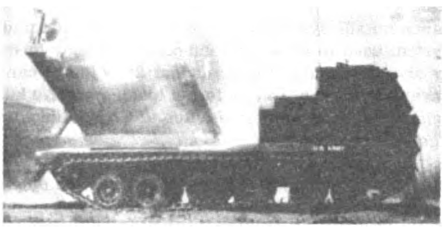
*Army TACMS engages indepth battle areas*

Army TACMS is an improved conventional ballistic missile system that will be used by the corps commander to destroy, delay, or neutralize enemy forces far beyond the range of cannons and rockets. The corps, by slowing down the enemy's ability to reinforce and support the central battle, can overcome the expected unfavorable force ratio. The requirement for Army TACMS also includes the attack of surface-to-surface missile (SSM) transporter erector launchers (TEL) as part of the anti-tactical missile (ATM) mission. Army TACMS will be transported and launched from the Multiple Launch Rocket System (MLRS) launcher. FY87 funds provide for a continuing development program to lead us to an early Initial Operational Capability (IOC).

While we must be prepared for both nuclear and nonnuclear contingencies, our first response capability must be adequate conventional firepower. As enemy units advance, there may be critical periods when large numbers of targets threaten to overwhelm the capacity of tube artillery. When this happens, we must be able to strike deep with great accuracy and massive firepower, as well as be capable of attacking enemy units up to the forward edge of our troop positions with concentrated, responsive fire.

The Multiple Launch Rocket System (MLRS) is the system that fills this need. It provides the Army with its first multiple rocket artillery capability since World War II. The MLRS rocket warheads contain a large number of improved conventional submunitions which are dispensed from the rocket high over the target and blanket the area with explosives and fragments. These submunitions are devastating against targets such as air defense sites, artillery positions, and troops in the open. The submunitions are also effective against the thin top armor of tanks and other fighting vehicles. The MLRS will be used against concentrations of enemy vehicles, enemy artillery, and as an air defense suppression means.

*Multiple Launch Rocket System provides massive and accurate fire power*



*Multiple Launch Rocket System*

The system also has incorporated a number of built-in efficiencies. The rockets are sealed in pods for shipment and require no maintenance after leaving the factory. The MLRS tracked carrier vehicle is a derivative of the Bradley Fighting Vehicle and has the same power train and level of armor protection for the crew's protection. Although normally operated by a three-man crew, in an emergency one soldier can operate the entire system. Devices on the launcher can determine both location and direction, and an on-board computer unit computes fire commands, sets fuzes, and automatically fires the rockets. The vehicle cab is designed so that crew-members can remain in the cab during rocket firing. It also has a positive overpressure system to protect the crew in the cab from exhaust gases during launch. The FY87 Budget is for continuation of the fifth year of a five year multiyear contract of this important new system.

The MLRS was developed by the US in cooperation with Germany, France, the United Kingdom, and Italy. In conjunction with Germany, France, and the United Kingdom, we are pursuing the development of Terminally Guided Warhead (TGW) submunitions. These submunitions will enable the MLRS to attack hard point targets in excess of 30 kilometers from the launcher. The concept calls for a rocket to fly to the kill zone, where the

*Terminal Guided Warhead*

*M198 Howitzer*

warhead will dispense multiple submunitions that seek out and destroy enemy hard targets. The FY87 budget will provide the continued funding for TGW component development and demonstration.

*M198*

The M198, 155mm Towed Howitzer, is the general support artillery for the non-mechanized divisions. It is also our newest howitzer. It is capable of firing 30 kilometers using a rocket assisted projectile. The M198 provides major increases in range and reliability over its predecessors and may be delivered by parachute or carried by a variety of cargo aircraft and the CH-47 helicopter. The M198 can fire scatterable mines, nuclear rounds, improved conventional munitions (ICM's), conventional high explosives, and Copperhead. Although our budget does not contain M198 procurement funds for this fiscal year, our long-range plan forecasts additional procurements beginning in FY88 and continuing through FY91.

*M119 for light divisions*

The Army's Light Divisions have a requirement for a lightweight howitzer with increased range and lethality over the existing M102 105mm howitzer The Army has been testing the in-production British Light Gun (L119) and in December 1985, type classified it for procurement as the M119. In 1987, the first year of procurement, 64 units will be purchased. Compared to the M102's range of 11.5KM, the M119 fires conventional HE to 14.3KM and 19.1KM with a Rocket Assisted Projectile (RAP) which is in development. A Dual Purpose Improved Conventional Munition (DPICM) is also being developed for the M119, a munition with a great increase in lethality. Under a licensing agreement with the UK, all UK production will occur, to be followed by co-production and then total on-shore U.S. production. The 105mm howitzer is scheduled to begin fielding in FY88.

*Improvements are part of overall modernization*

The mechanized and armored portions of our force structure have the M109 self-propelled 155mm howitzer and the M110 8-inch self-propelled howitzer. These weapons date back to the 1960's, but have been improved over the intervening years. We have extended the range of the 155mm howitzer to 24 kilometers and the range of the 8-inch howitzer to 30 kilometers using rocket-assisted projectiles. We are continuing to modify the M109 in order to extend the life of the system to at least the year 2000. In this year's

*M109 Howitzer Improvement Program*

budget request we have asked for continued funding to procure modification kits that will provide increases in survivability and capability.

We are also conducting research and development of improvements that will provide additional increases in armament reliability and survivability against NBC attack and counterfire, as well as increased responsiveness and reduced crew fatigue. The howitzer improvements are only part of the overall effort leading to modernization of the Artillery System.

*G/VLLD*

*Ground/Vehicle Laser Locator Designator*

The Ground/Vehicle Laser Locator Designator (G/VLLD) is used by artillery forward observers. This dual-purpose device is used by a forward observer to determine target ranges precisely and to designate targets for laser-guided projectiles, missiles, or bombs. The G/VLLD achieved its initial operational capability in 1982. The FY87 budget provides for continued procurement. In our armored and mechanized units the Fire Support Team (FIST) requires a mounted vehicular capability. The new Fire Support Team Vehicle (FISTV) will give the FIST armor protection, mobility, and built-in communications which will enable it to operate with fast-moving armor, mechanized infantry, and cavalry units, and be responsive to the maneuver commander.

*FISTV: Responsive to commanders*

The FISTV represents a combination of new laser improved artillery observer equipment with the proven performance of the M113A2 personnel carrier. The vehicle is very similar in appearance to the Improved TOW Vehicle and incorporates the G/VLLD in an armored, elevated module mounted on an M113A2 chassis. The FISTV is equipped with a north-seeking gyro that provides the directional data needed for accurate artillery fire requests. It can operate in hull defilade with only the elevated G/VLLD module exposed, thereby increasing survivability. The FY87 funding provides for continued procurement of FISTV Modification Kits. The Army plans to convert 178 M113's to FISTV's this year.

The first vehicles were fielded to the 24th Infantry Division in August 1985. The effective management of the enhanced capability we have been describing is an important responsibility of the Field Artillery. Specifically, our artillerymen have the "fire support mission" for the collective employment of mortars, field artillery, air support, naval gunfire, and other lethal and non-lethal (smoke, illumination) attack systems in support of combat operations. To accomplish this mission, fully automated support for planning, coordination, control, and execution of close support, counterfire, interdiction, and air suppression fires is required to maximize our combat power.

*Fire Support Team Vehicle (FISTV)*

*TACFIRE: Severely limited for tomorrow's battlefield*

Our Field Artillery Tactical Fire Direction System (TACFIRE), as currently fielded, represents first generation technology that provides automated data processing of technical fire control data, selection of munitions and volume of fire for enhanced target accuracy. However, the requirements for a total fire support package that provides (1) development of targets and delivery of fires; (2) coordination and control of fires and fire support assets; and (3) planning for future operations represent severe limitations for TACFIRE on tomorrow's battlefield. In essence, TACFIRE will not meet the data processing needs of the fire support system for the 1990's and beyond. It also is not economically smart to produce TACFIRE spare parts by mid 1990 because of outdated technology. TACFIRE's replacement, The Advanced Field Artillery Tactical Data System (AFATDS), will significantly broaden and modernize the US Army fire support command, control, and coordination systems. The AFATDS will expand the TACFIRE capabilities with no increase in personnel requirements and will provide automated support for the Fire Support Control Segment of the Army Command and Control System (ACCS) during the 1990-2010 timeframe. Compatibility and interoperability will be provided with all existing and planned US Army Field Artillery Systems to include sensor systems, related NATO systems from the United Kingdom (BATES) and the Federal Republic of Germany (ALDER), the Marine Integrated Fire and Air Support System (MIFASS), and other Functional Control Segment Systems in the command and control architecture.

*AFATDS: Expanded automated capabilities*

The AFATDS will retain selected systems of the present TACFIRE for total system integration. For example, the related technical system which provides firing data to each individual weapon will be retained. The Fire Support Team and Forward Observer Digital Message Devices will continue to be the "forward entry devices" in AFATDS and are "not" part of the AFATDS funding program.

Lastly, AFATDS represents the Army's first automated program that is truly software driven. Specifically, prior to any final hardware consideration, user requirements must be accurately defined and then translated, through software development, into a DOD higher order level language (Ada). Once the user software is written, then the hardware will be selected. This approach ensures users satisfaction; it maximizes detailed functional definition of the fire support, command, control and coordination requirement; it provides a basis for a market survey for procuring hardware components that is driven by the user requirements.

Target acquisition within the fire support mission area is of equal importance to fire delivery and control systems. The Firefinder system, consisting of AN/TPQ-36 mortar-locating radar and AN/TPQ-37 artillery locating radar, provides our soldiers the ability to automatically detect and locate enemy batteries in realtime and to attack them with timely and accurate counterbattery fire. The final procurement requests for Firefinder were FY81 (AN/TPQ-36) and FY83 (AN/TPQ 37), with the last units scheduled for delivery to the Army from these buys in July 1986 (AN/TPQ 36) and March 1987 (AN/TPQ 37). Plans project completion of fielding in 1988.

The effective use of field artillery weapons depends upon accurate location, direction, and estimates of the influence of the atmosphere on artillery projectiles, rockets, and missiles as they travel to their targets. We now have automated systems to provide these data.

*Artillery survey workload reduced*

The Position and Azimuth Determining System (PADS) is an automated, self-contained inertial surveying system which provides the field artillery with a secure, all-weather, day/night means for rapid survey control. Surveys that normally take the conventional five-man survey party 12 hours can now be accomplished by a two-man PADS party in less than two hours. The FY87 request will purchase 107 systems which will add to the 360 systems already procured.

*Improved accuracy via timely meteorological data*

The new Meteorological Data System (MDS) will insure that artillery fires are corrected for changing atmospheric conditions. This is significant since greater ranges of artillery projectiles will cause them to be exposed to atmospheric effects for increased periods of time. Reliable data are also required on how weather will affect electronic warfare and battlefield obscurants employed by the enemy. In a 'dirty battlefield" environment, where anything from a severe storm to chemical or nuclear conditions may prevail, we must have timely meteorological data. The MDS will accurately measure the atmospheric variations and automatically transmit those variations to TACFIRE and other automated systems that compute artillery firing commands.

*Ammunition stabilization provides warfare capability*

Our ammunition request provides for increased readiness by buying more rounds for artillery for essential modernization by procuring smart munitions such as Copperhead, and for improved sustainability through modernizing old production facilities and increasing explosives and propellants production capability. Each component of the ammunition budget responds to a deficiency in readiness, modernization, or sustainability. The stabilization of the ammunition account is key to providing the warfighting capability we need. Within the Army budget, field artillery ammunition has been allotted the largest portion of our resources for munitions procurement. Major items in this category are 8-inch and 155mm Improved Conventional Munitions, 155mm Area Denial Artillery Munitions and Remote Antiarmor mine system projectiles.

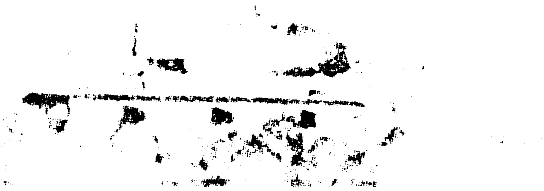
*Munitions R&D*

Opportunities exist for making our weapons more effective through the use of modern munitions and advanced guidance systems. By making greater use of these technologies we can achieve a significant increase in our conventional capability in a cost-effective and timely fashion. The munitions research and development programs cover all types of conventional munitions from exploratory development through engineering development. Major areas include: technical base programs for large caliber munitions development and ballistics technology work applicable to all systems; development of modernized ammunition for the 105mm howitzers; field artillery munitions such as the Sense and Destroy Armor munition—a top attack, antiarmor submunition employing improved sensing for broad application to weapon systems such as the MLRS and 155mm howitzer; and

numerous smaller projects for the development of fuzes and propellants. The FY87 request will allow the Army to continue this critical research and development area.

A successful product of munitions research and development is the precision guided projectile known as Copperhead. Until the advent of Copperhead, the field artilleryman faced the statistical probability of wearing out his gun tube before hitting a moving tank. This laser-guided 155mm howitzer projectile changes those odds dramatically. Copperhead is the only deployed field artillery munition with the ability to yield a high probability first round kill against moving hard point targets.

***Copperhead: Dramatic increase in single-shot kill probability***



*Copperhead*

*Field Artillery Ammunition Support Vehicle (FAASV)*

Copperhead is fired from existing 155mm howitzers. It uses a built-in, semiactive laser seeker which makes it possible for the round to destroy stationary or moving armored and other high value targets, at ranges up to 16 kilometers, with a high single shot kill probability. As the projectile descends toward the intended target, its laser seeker searches for and acquires the reflections of a laser beam. This beam can be projected onto the target by G/VLLD, FISTV, AHIP or Apache helicopters or by a remotely piloted vehicle. The projectile corrects its course through the use of its fins as it "homes" to the laser spot on the target.

Copperhead has been in production since 1981 with over 15,745 rounds produced through FY85. Since July 1982, Copperhead has demonstrated better than 80% reliability. FY87 funding will be used to maintain production at efficient rate while continuing to build up our war reserve inventory.

*FAASV*

As a part of our modernization effort, we are also looking at improvements in ammunition hauling, handling, and survivability. In FY83 we initiated procurement of the Field Artillery Ammunition Support Vehicle (FAASV), which is equal in mobility to the self-propelled howitzers in our inventory and provides armored protection for both crew and ammunition. FAASV is being procured for deployment in Europe, Korea and select CONUS units. The FY87 request will add 141 FAASVs to the Army inventory.

# AIR DEFENSE

The Army's Air Defense mission area includes those activities involved with the detection and engagement of the enemy air threat with ground-to-air gun and missile systems, in coordination with the other combined arms and Air Force interceptor aircraft.

*Soviet air threat*

Without adequate air defense coverage, ground combat elements, supply lines, command centers, Air Force strike bases and other high-value targets are exposed to destruction by fixed-wing and rotary-wing attack aircraft. Warsaw Pact forces have over 3,600 combat aircraft in Central Europe, including bombers, fighters, and helicopters. Quality and quantity are on the rise. Ground attack aircraft such as Flogger, Fencer, and a new production ground support fighter, combined with the HIND and HAVOC attack helicopters pose a deadly threat to armor and mechanized forces. In addition to the aircraft threat, there is an increasing threat from the growing numbers and types of tactical missiles and air-launched missiles.

*Air defense modernization*

For many years, short range air defense was provided by Redeye, Vulcan and Chaparral with medium to high altitude air defense provided by HAWK and Nike-Hercules. The Army's current air defense modernization program provides a new mix of systems that will be effective against the growing air threat through the 1990's.

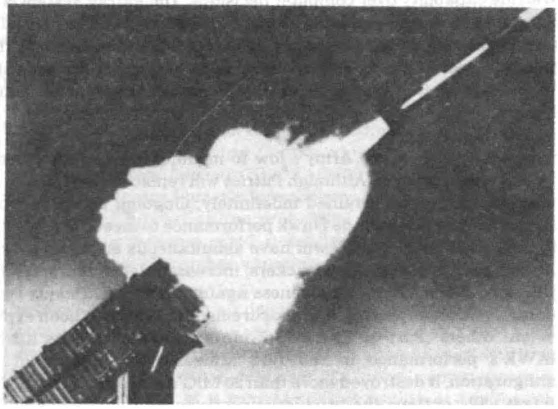
*Patriot: A key system*

In future wars, we can expect to experience saturation raids by large numbers of sophisticated aircraft employing intense electronic countermeasures. In response to this, we are fielding Patriot as a replacement to Nike-Hercules and improving the HAWK missile system.

One of the main shortcomings of Nike-Hercules, which was in the force from 1958 to 1985, was that a battery could only engage one target at a time. The operator had to wait until the missile intercepted the target before firing another missile. Patriot, on the other hand, can attack and destroy several enemy targets while simultaneously tracking other targets.

*Reduced Manpower*

Due to its advanced technology, Patriot is operated with fewer soldiers than its predecessors. Each Patriot launching station contains four ready-to-fire missiles. The missiles, which are sealed in canisters that serve as both shipping containers and launcher tubes, require no field maintenance. Each Patriot battery contains up to eight trailer-mounted launchers that can be



*Patriot*

*I-HAWK*

widely dispersed. Communication with the Engagement Control Station is made via secure data link.

***Multiple engagement capabilities***

Enemy targets can be tracked and prioritized for destruction through the interaction of Patriot's radar and computer. The radar can guide several missiles at the same time, updating priorities as threat aircraft are engaged. Patriot employs a new guidance concept called Track-Via- Missile. As the missile reaches the area of an enemy aircraft, it informs the radar where it is in relation to the target. A computer then makes calculations and directs the missile on a path that insures a kill. Operating modes vary from manual mode to fully automatic mode. The system's two operators always retain full

override capability over computer decisions. The Patriot system is currently in production and is being adopted by our NATO allies. The first fully trained and operational battalion was deployed to Europe in early 1985. The second battalion was deployed in September 1985. The FY 87 budget will support the procurement of additional fire units and the continued fielding of the system.

*New Guidance concept*

The mainstay of the Army's low to medium altitude air defense is the HAWK missile system. Although Patriot will replace some HAWK units, the HAWK force will be retained indefinitely. Ongoing and planned product improvements will upgrade Hawk performance to meet the projected threat through the 1990's. HAWK will have simultaneous engagement capability against close-in saturation attackers, increased detection range, improved reliability, and greater effectiveness against jamming. Twenty-two foreign countries have the system, and procurement interest has been expressed by several others. Part of this worldwide acceptance can be attributed to HAWK's performance in the 1973 Mideast War, where, in its basic configuration, it destroyed more than 20 MiG's and other aircraft. The FY87 budget will continue the product improvement program and will procure replacement rocket motors.

*I-HAWK: Upgraded and reliable*

The Army-led, Antitactical Missile (ATM) program began in FY83 to develop counters to the growing tactical surface-to- surface missile threat. The program consists of concurrent near-term to long-term approaches to solve counterforce, terminal defense, and battle management problems. Near-term efforts upgrade existing air defense systems to field an early point terminal defense capability against conventional tactical missiles. Mid-term efforts focus on development of counterforce and anti-cruise missile capabilities. The full solution will include both active and passive countermeasures, and will require a combination of systems, including Army TACMS and current Army air defense systems as well as possible new systems, sensors and battle management capability. FY87 funds will provide for research and development work in threat vulnerability, counterforce requirements and terminal defense capability.

The Army is committed, as a top priority, to solve the critical shortfall in air defense for our forward maneuver elements created by the SGT YORK program termination. A Forward Area Air Defense Working Group (FAADWG) has developed a Counter Air Concept using air defense artillery, the other combined arms and the U. S. Air Force to counter the growing air threat. The FAADWG identified an air defense program that integrates weapon systems, sensors and command, control and communications architecture into a system optimized to counter the entire spectrum of the air threat. The FAAD program is a system of major subsystems consisting of a command, control and intelligence subsystem; a non-line of sight weapon; line of sight weapons for the forward and rear of the division; and combined arms initiatives including air-to-air Stinger, improved tank ammunition and potential improvements to the Bradley Fighting Vehicle gun and fire control. Combinations of available air defense weapons and new technologies are being carefully looked at to provide the needed forward air defense. A final

list of candidates will be identified and evaluated in FY86/FY87. FY87 funding is essential to the rapid fielding of this integrated air defense program.

The first major element and keystone of the FAAD system is a modern command, control, and intelligence subsystem which will integrate forward air defense weapons into a quick reacting, comprehensive, and lethal arsenal. The Forward Area Air Defense Command and Control and Intelligence (FAAD C2I) subsystem (formerly SHORAD C2) is being developed to provide maximum effectiveness from our forward area air defense weapons. This C2I effort focuses on increasing the probability of successful engagement of hostile targets by insuring rapid, timely acquisition and dissemination of information on the air combat situation.

The present forward area air defense method of accomplishing command and control is totally manual. Weapons control information and sensor data from Air Force and high to medium altitude air defense systems is provided to forward area air defense weapons via voice communications. This information is received at a central control facility at the forward area battalion where it is manually filtered, plotted and retransmitted by voice to the appropriate air defense and ground combat elements. This method is time consuming and limits the probability of successful air defense operations.

The FAAD C2I development will automate and streamline this process to enable us to successfully engage the air threat within the division airspace. Computer processors, graphic displays, control terminals and data links will replace most human actions and voice communications. The new subsystem will provide forward area gunners and commanders with the required data quickly and simply and with responsive, flexible, less restrictive weapons controls. The FY87 funds continue full- scale engineering development of the switching architecture and selection of the ground sensor that is planned to begin in FY86. FY87 will also continue concept development for an aerial sensor.

*Tri-service development of "friend or foe" identification system*

The intelligence part of FAAD C2I includes the sorting of friendly and hostile aircraft during aerial combat. The ability to positively identify hostile aircraft remains a significant limitation to our air defense forces, particularly for short range air defense weapons which are currently limited to visual aircraft identification and identification friend or foe localized to individual weapons. In the future we expect to be able to operate beyond visual range through our weapons improvement and acquisition programs. Our efforts are focused on noncooperative identification of both hostile and friendly aircraft. Several of these have shown excellent potential in early demonstrations. We are making limited improvements in our current cooperative friendly identification systems and participating in tri-service development of a new cooperative friendly identification system for selected air defense systems.

Improved positive hostile and friendly identification capabilities combined with improved, automated command and control capabilities will maximize

the effectiveness of our air defense forces. FY87 funding continues development and testing of improved identification capabilities.

The second subsystem in the Forward Area Air Defense System is the Non-line-of-sight weapon. The weapon is intended to be employed in defilade behind the FLOT and out of range of enemy direct fire systems. This subsystem, will give the Army Air Defense the capability to kill helicopters either hovering behind mask or on the ground. The Fiber Optic Guided Missile (FOG-M) is a candidate for this mission. The FOG-M is a precision guided missile which uses a fiber optic cable to transmit seeker images to the control vehicle and guidance commands to the missile. The weapon is a relatively mature system which has been developed largely by the Army's Missile Command. Alternative concepts for the Non-line-of-sight weapon including a ground launched version of the Advanced Medium Range Air-to-air missile (AMRAAM) are also being investigated. FY87 funding is critical to the early fielding of this part of the Forward Area Air Defense system.

The third component of the FAAD are Line-of-sight-forward weapons which will be used in the close combat zone of both light and heavy forces. These weapons are designed to kill or suppress enemy fixed wing and exposed rotary wing aircraft. A gun/missile mix is contemplated to optimize the strength of both weapon types. In general guns are more cost effective and provide quick reaction high volume fire against the close-in targets. Missiles are more effective against the longer range targets. A request for information has already been released to industry to assist in the preparation of material requirements for the heavy division. Because there are numerous weapons which could potentially perform the LOS-F mission an IOC as early as 1989 is conceivable. However, this is predicated on FY87 funding.

The fourth element of the FAAD system is the Line-of- sight-rear weapon better known as Pedestal Mounted Stinger. This weapon uses the manportable Stinger missile fired from a fire unit mounted on a High Mobility Multipurpose Wheeled Vehicle (HMMWV) and will provide defense for the rear area of the division. Pedestal Mounted Stinger will be procured in FY87 as a non-developmental item based on an FY86/87 evaluation of candidates.

Until the FAAD system is fielded the Army will rely on Stinger, Chaparral, and Vulcan to perform forward air defense.

*STINGER*

Stinger is the Army's manportable air defense missile system. It provides air defense protection for forward deployed ground combat units. Although Pedestal Mounted Stinger will eventually replace most MANPADS teams, Stinger will continue to be used in its shoulder fired configuration when required. Stinger was developed to replace the aging Redeye system, which was first fielded in the mid-1960's and had limitations when matched against the current and projected enemy air threat. Stinger was deployed to active Army units in Europe in February 1981.

Stinger overcomes many of Redeye's shortcomings with improved range and maneuverability, the ability to attack much faster targets, and, most

Guard as part of their modernization program with the first battalion fielded in 1985. To keep Chaparral current against the threat's countermeasure capability, a new seeker using Rosette Scan Seeker (RSS) technology started production in FY86 with initial facilitization. The first production buy of new seekers will occur in FY87.

*Chaparral: Cost-effective and continually improved*

Improvements fielded to date include an improved infrared guidance which provides a forward engagement capability, an Identification Friend or Foe (IFF) System to assist the gunner in identifying friendly aircraft, a smokeless rocket motor that increases survivability by reducing the visible smoke trail when the missile is launched, and a Forward Looking Infrared (FLIR) night sight for improved adverse weather and night target acquisition. Future improvements include adding other modifications to improve system performance, reliability and NBC protection.

The Product Improved Vulcan Air Defense System (PIVADS) was developed to improve tracking and gun pointing accuracies and increase maintainability and availability of the current 20mm Vulcan air defense gun to provide an interim capability. Improvements include the replacement of the present disturbed reticle by a director type sight, the replacement of the analog computer with digital fire control electronics, modification of azimuth and elevation systems to reduce backlash and incorporation of built-in-test equipment. A contract has been signed for 285 PIVADS kits and modification is expected to begin in early 1987.

*PIVADS improves tracking and aiming capabilities*

*Product Improved Vulcan*

## COMBAT SUPPORT

We are well acquainted with the Soviet employment of massed armor and the formidable threat it poses to our forces. Minefields and other obstacles which are tied to natural terrain features and integrated into the battle plan serve as a significant combat multiplier. Properly integrated minefields and obstacles serve to slow the rate of movement of mechanized forces thus enhancing the effectiveness of our direct and indirect fire systems. They also serve to force the threat to alter his tactical maneuver plans and force the employment of time and resource-intensive breaching systems. The formations become compressed, thus providing greater vulnerability to our armor killing weapons systems. Should the enemy attempt to simply run through the minefields, he will pay a heavy price in tanks. Our modern mine systems have significantly improved lethality. Finally, attempts to avoid the mined area require modification of his maneuver plans at the Operational level. Again, his maneuver rate is slowed and may well force him into other preselected kill zones, disadvantageous terrain or to adopt other less desirable options such as dismounted maneuver.

On the fluid, rapidly changing battlefield of the future, it is imperative that minefields be emplaced as the ebb and flow of the battle dictates. In the past, the emplacement of mines was a slow, laborious and logistically intensive process and the mines had to be emplaced long before the enemy commanders intentions became clear. Our new Family of Scatterable Mines (FASCAM) changes this situation. Our new delivery capabilities significantly improve emplacement time and provide for a more flexible response to changing tactical situations. Additionally, we have attained a new capability with these systems,. We can now employ mines in rear area on key targets such as artillery units, Command and Control centers, logistic complexes, concentrations of armor and routes which may or are being used by reinforcing or counter attacking units.

*Minefields help deal with massed armor*

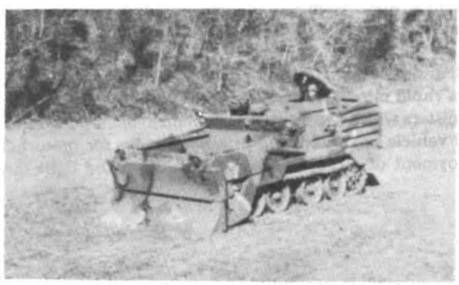
The Remote Anti-Armor Mine (RAAM) and the Area Denial Artillery Munition (ADAM) are 155mm artillery delivered mines and are in production. We will continue to provide for RAAM and ADAM procurement in FY87.

The Volcano mine dispensing system will begin procurement in 1987. Volcano is a rapid mine dispensing system with mines loaded into mortar-tube-like canisters which are placed in common dispenser racks for helicopter and ground vehicle use. Volcano initially provides for the urgent need for rapid employment of large tactical minefields in the light forces. In the

outyears, the Volcano ground system will replace the GEMSS in heavy forces. The Modular Pack Mine System (MOPMS) will begin production in 1986. The MOPMS is a foot-locker sized module containing 21 mines. The MOPMS replaces the heavy and bulky conventional mines now used as a basic load in combat arms units and will also be used in special mining situations such as closing lanes and gaps in large tactical minefields. MOPMS mines are explosively deployed from the module when a threat arises. Otherwise, the module is retrieved for future use.

The other side of the Mine Warfare picture is our need for countermine equipment. The threat has learned the historical value of mines well and is prepared for the employment of mines during all phases of the battle. We can expect him to fully exploit his extensive mining capability. Our combat units require versatile and effective countermine systems to provide the freedom of maneuver necessary in the AirLand Battle. We are far from having a satisfactory countermine capability in the field, while the Soviets are well equipped in this critical area. Continued procurement of several key countermine systems is supported in the FY 87 budget. The Mine Clearing Line Charge (MICLIC) is an explosive line change which clears a path 8 meters wide and 100 meters long through deliberately placed minefields. The mine clearing roller and plow systems which are mounted on tanks provide flexible and effective breaching equipment in nearly all terrain and weather conditions for the numerous hastily emplaced minefields we will encounter.

As key members of the Combined Arms Team, engineers have the responsibility for providing specialized support to ensure the mobility, countermobility and survivability of the maneuver elements. In the lethal environment of the main battle area, the combat support role of the engineers greatly increases the combat effectiveness of our fighting forces by providing terrain reinforcement, construction of fighting positions and obstacles, breaching barriers, clearing obstacles and preparing bridge crossing sites. Today, this mission is even more critical as the battlefield becomes increasingly mobile.



*Armored combat earthmover*

The M9 Armored Combat Earthmover (ACE) is uniquely capable of accomplishing mobility, countermobility, and survivability tasks in the forward area of the battlefield. The M9 has the speed and all-terrain mobility to move with the combat force and provide critical support when and where needed. The M9 offers armor protection against artillery fragments and light direct fire weapons as well as operator protection against chemical and biological agents. The M9 is air transportable and air dropable. It can swim, dig, bulldoze, haul, and move with the flow of the battle. The M9 is an essential element of the combined arms team on the highly lethal and mobile AirLand Battlefield.

*Armored Combat Earthmover*

Chemical warfare may very well be the Army's most vulnerable area in the 1980's. Even though the US is formally committed to the policy of "no first use" of lethal or incapacitating chemical agents by adherence to the Geneva Protocol of 1925 and seeks a complete and verifiable ban of lethal chemical weapons, the threat to our forces is high. Today, US forces are facing a chemical threat from an adversary that is the best prepared nation in the world in the use of chemical warfare. Without question, the Soviet Union possesses a formidable offensive capability to wage chemical warfare for an extended period and their leadership continues to devote significant resources to research, development, and procurement of more advanced chemical weapons and equipment. They also have a large and well equipped dedicated chemical force. All units within their armies train extensively for chemical warfare.

*Chemical threat*

Given the disparity between US and Soviet chemical warfare capabilities and evidence of Soviet use of chemical warfare directly or through surrogates, we must promptly modernize our own retaliatory capability. The US currently has a limited stockpile of chemical munitions. All of these munitions are of the unitary design; that is, they contain the actual agent in its final form. These munitions are all over 16 years old, and they are costly to store, maintain in a usable status, and transport in a safe manner. Additionally, the stockpile is composed of weapons and agents that are inadequate and in some cases inappropriate for the modern battlefield. The best option for developing and insuring a credible retaliatory stockpile in support of the national policy of deterrence is binary modernization. The binary concept uses two separated nonlethal chemical components that combine during the flight to the target to form a lethal chemical agent. In addition to the added safety and flexibility afforded by binary munitions during production, storage, and movement, binary modernization will allow us to update weapon and agent mix. An R&D effort is underway to apply binary technology to rocket warheads.

*Stockpile—Aging and inappropriate*

*Binary concept*

The Congress, recognizing the need to modernize the chemical weapons stockpile, appropriated \$23.15 million in FY81 for construction and facilitization of the Integrated Binary Production Facility at Pine Bluff Arsenal, Arkansas, to allow for future production of the 155mm GB-2 (nonpersistent) artillery round. Initial construction began in October 1981, and was completed in December 1984. The Army FY87 program includes funds for procurement of 155mm projectiles. Also, the Army ammunition

production base in the FY86 program provides for facilities to produce Bigeye Bombs in support of Navy and Air Force procurements.

*Chemical protection equipment*

In addition to modernizing the chemical weapons stockpile, we must continue the procurement of chemical protective equipment in FY87 to improve the ability of our forces to survive an initial chemical attack. More procurement, research, and development are required before we can sustain combat operations in a chemically and biologically contaminated environment. A new protective mask providing improved protection and a simplified collective protection system for use by tactical units will continue to be procured in FY 87. Also, collective protection systems will continue to be integrated into our command, control and communications systems and combat vehicles.

The FY87 chemical-biological program continues our efforts with universities and industry to broaden the technology base required to support materiel needs and to develop improved chemical-biological defense materiel. Development will be completed on numerous collective protection equipment for shelters, vans, and vehicles. Chemical- biological agent detection and alarms development will continue on a remote sensing alarm, an automatic chemical agent detector and alarm, and an automatic liquid agent alarm. Development of a mechanized NBC reconnaissance vehicle was initiated in FY 85. Work will also continue on improved decontamination systems including non-aqueous decontamination systems for tactical vehicles and equipment, and a dual purpose system that will be capable of making smoke for battlefield obscuration decontaminating equipment exposed to chemical-biological agents.

Nuclear artillery projectiles have provided part of the US nuclear deterrent for the past 30 years. Currently fielded nuclear artillery projectiles, which incorporate 1950's era technology, must be replaced to assure continued reliability and effectiveness. Modernization programs are underway. We are currently completing procurement of the 8-inch nuclear artillery projectile and development of the improved 155mm nuclear projectile is continuing. These nuclear artillery projectile programs will provide a Short-Range Nuclear Force (SNF) that will continue to provide a credible nuclear deterrent by assuring the collective survivability of NATO SNF and enhancing the survivability of our conventional firepower.

*Deep reconnaissance capabilities*

Today's battlefield requires the commander to be able to look over the next hill out to 300 kilometers deep into the enemy's rear. The commander must be able to acquire data necessary to assess the situation, target a threat force and execute real time operations continuously and simultaneously to interdict threat forces. Unmanned aerial vehicles (UAVs) have the potential to improve the commander's ability to accomplish these tasks. UAVs have the capability to fulfill important battlefield functions: target designation and artillery adjustment; reconnaissance, surveillance, and target acquisition; attack; command, control and communications; air defense early warning; psychological operations; deception and provide meteorological data. Based

on the combat-oriented functions, the Army has defined three categories for its family of UAVs: TADARS, General Purpose and Expendable. The Army has defined two current members of the UAV family: the general purpose Corps Intelligence Electronic Warfare (IEW) UAV and TADARS Aquila.

The Army has defined the requirements and a non-development item (NDI) acquisition approach for the Corps IEW UAV, which will be started in FY86 and FY87.

*RPV fills need for timely intelligence*

The Aquila is a militarized system designed to perform target designation, artillery adjustment and laser designation in a high intensity combat electronic warfare environment. The Aquila can fly above key enemy zones in order to gain required data when the defensive strength of the enemy is likely to make manned reconnaissance extremely risky.

*RPV*

The Aquila Full Scale Development (FSD) flight testing started in July 1982. Since then more than 278 flights have been flown with an overall success rate of 92%. The system has experienced technical performance problems. In recent tests, paid for by the contractor, launch, recovery, navigation, telemetry of TV video, jinking, 3-hour endurance, long-range hand-off between ground control stations and laser designation for Copperhead against both stationary and moving targets have all been successfully demonstrated. FY86 RDTE funds will support continuation of developmental and operational tests, continuation of development of the FLIR night vision sensor.FY87 RDTE funds will complete operational testing of Aquila and continue FLIR development. Aquila procurement will begin in FY87 with acquisition of an increment of the training base.

*Joint Tactical Fusion Program*

Modern sensor systems are capable of providing massive volumes of raw intelligence data. In order to be of use to the tactical commander, the collected data must be correlated, integrated, and interpreted with minimal delay. The manual processes now employed in the analysis of tactical intelligence information are inadequate to cope with the volume of collected data in sufficient time to satisfy the commander's needs. This is particularly true

in an AirLand Battle, Deep Attack environment, where effective employment of new weapons systems depends on timely and accurate information on enemy activity. The Joint Tactical Fusion Program will remedy this situation through the introduction of automated tactical intelligence fusion systems for the Army and Air Force. The Army system, the All Source Analysis System (ASAS), will provide automated assistance to intelligence processing (fusion) and will also support related areas such as target development, collection and mission management of intelligence and electronic warfare systems, and operations security. The Enemy Situation Correlation Element (ENSCE) will perform similar functions for the Air Force and is being developed concurrently with the All Source Analysis System. Maximum commonality in hardware and software is planned between the Army and Air Force systems to ensure that the ground and air commanders share a common perception of the enemy situation. Current plans call for fielding of baseline fusion systems beginning in the mid- 1980's. These systems will undergo evolutionary development leading to the fielding of objective systems in the early 1990s.FY87 RDTE dollars will complete the design of the large intelligence processing and communications interface modules, type classify the analyst workstation, deliver intelligence processing software for PACAF/USAFE computers and develop the first software release ASAS/ENSCE. FY87 OPA dollars will procure limited capability configuration ASAS for the USA Intelligence School, and two divisions.

*JOINT STARS permits quick reaction battlefield management*

The Joint Surveillance and Target Attack Radar System (JOINT STARS) will provide wide area surveillance of the battlefield. It will have both a moving and a fixed target capability permitting detection and location of targets such as fixed and moving vehicles, command posts, assembly areas, and low-flying helicopters and fixed-wing aircraft. JOINT STARS will broadcast simultaneously to multiple ground stations at division and corps, and will be integrated with the All-Source Analysis Center and the Advanced Field Artillery Tactical Data System to provide both battlefield management and quick- reaction, realtime targeting. Operational effectiveness will be enhanced by cueing from other sensors. In FY87 the Army will provide the initial ground station modules for fielding to Europe.

*Offensive electronic warfare*

Offensive electronic warfare operations are calculated to disrupt enemy command, control, and communications capa- bilities. Every unit is tied by an electronic apron string to its next higher echelon. Disrupting the Soviets' communications network by means of electronic warfare may be a key means of slowing a Warsaw Pact attack by precluding the timely massing of forces and thereby making it vulnerable to eventual defeat. The commander of a force needs to know what the enemy is doing. One way he can get this information is by intercepting and locating enemy emitters. Army systems to provide location and intercept of communications and radar emitters are mounted in aircraft and in wheeled or tracked vehicles. TRAILBLAZER and TEAMPACK systems, which are currently being fielded, are ground-based systems whose targets are, respectively, communications and radar signals. Fielded airborne systems are GUARDRAIL and QUICKLOOK which are being upgraded through product improvements.

*Guardrail*

*Quick Look II*

Guardrail V is a combined airborne sensor and ground processing facility communication intelligence system with proven ability to provide near-realtime data on the location of enemy electronic emitters. Guardrail, in the RU-21H platform, has some limitations such as an unpressurized aircraft and limited frequency coverage. Thus, we are continuing the procurement of the Improved Guardrail (RC-12D), a system that corrects those limitations.

*Countering electronic emitters*

Quick Fix is an airborne offensive communications intercept, location and jamming system that will deny the enemy the use of his radios during key periods of battle. It does this by intercepting and jamming enemy communications. Quick Fix is designed to operate against air defense units and maneuver units. Quick Fix I is currently employed in a modified EH-1H aircraft. Future Quick Fix II systems will be mounted in the EH-60A BlackHawk aircraft.



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*Jamming enemy communications*

Quick Look II is an airborne, computer-controlled system mounted in a Mohawk aircraft that detects, locates, and identifies enemy radars. It provides tactical field commanders with timely data on enemy missile, artillery, and antiaircraft weapons. The FY86 budget contained limited funds for product improvements to the aircraft and includes RDTE funds to support the consolidation of Guardrail and Quicklook into a single platform. Procurement funds start in FY88.

*Radar emitters*

In the area of ground-based communications jammers, our Combat Electronic Warfare Intelligence (CEWI) units will be equipped with the medium-power AN/TLQ-17A, TRAFFIC JAM, and the high-power AN/MLQ-34, TACJAM. In addition, the Army is developing a family of low-power, expendable jammers that are designed for hand emplacement or delivery by artillery projectiles. Procurement of the hand-emplaced jammers began in FY84. The Army is also equipping Combat Electronic Warfare Intelligence (CEWI) units with the PIRANHA radio electronic countermeasures set, OG-181. This device allows us to use our AN/VRC-12 series tactical radios as jammers and provides an ECM training capability to both the active and reserve forces.

# COMBAT SERVICE SUPPORT

In the initial stages of most potential conflicts, we can expect to fight outnumbered and outgunned. Therefore, the commander must have the ability to move forces rapidly about the battlefield in order to optimize their overall effectiveness and to avoid decisive engagements with forces having superior strength. The key to this capability is enhanced mobility, both air and ground, which enables us to position our forces in the right place at the right time. The Combat Service Support major mission area is an aggregation of mission areas designed to provide the commander support to the weapons systems, support systems, and their operators and crews.

*UH-1: a good, but limited performer*

The Blackhawk helicopter, the high end of the high-low utility helicopter mix, will perform air assault, air resupply and aeromedical evacuation missions, and answers the Army's need for improved battlefield mobility. Its predecessor, the UH-1, is an excellent and reliable helicopter, but is power-limited so that during hot weather and in high-altitude conditions, its payload is greatly reduced. Furthermore, in Vietnam we learned that we must reduce the vulnerability of future helicopters to small arms ground fire.

*UH-60 Blackhawk*

*Blackhawk: a versatile aircraft*

The UH-60A Blackhawk is clearly superior to the UH-1. It can carry more than twice the UH-1 payload and can transport a complete, fully equipped squad faster in most weather and altitude conditions. Blackhawk also adds significantly to the mobility of the division by having the capability to reposition equipment such as the 105mm howitzer, its crew of six, and up to 30 rounds of ammunition in a single lift.

*Survivable*

The critical components in the Blackhawk are either armored or redundant to enable it to withstand multiple small arms hits. Tests have demonstrated its ability to continue flight for a minimum of 30 minutes after sustaining damage from projectiles as large as the 23mm high-explosive incendiary round. The airframe is designed to absorb impact forces by progressively deforming on impact, thereby protecting the crew in a crash. The Army's experience in Grenada with the Blackhawk proved the aircraft to be very survivable.

*Blackhawk*

The Blackhawk has been fielded in Korea, WESTCOM, Panama, Europe and FORSCOM units. Fielding to ARNG, USAR, USAREUR Medevac and FORSCOM units are in process and will be followed by a continuation of fielding to FORSCOM units.

*Stabilized production rate*

*Successful multi-year contracting*

The Blackhawk is presently being procured under a second multiyear contract (FY85-87), which has significantly stabilized the production base and produced substantial savings to the Government. FY86, the first year of the FY86-FY88 T700 series multiyear contract, included procurement of engines for the Army's UH-60 Blackhawk, AH-64 Apache, EH60 Quick Fix, Navy's SHG-60B SeaHawk and a number of other Navy programs. This highly successful program is its second multiyear contract and has resulted in significant savings to the Army. The program continues toward meeting the procurement objective of 1107 Blackhawks. The Army has accepted 700 Blackhawks as of November 1985. The Army is requesting 78 Blackhawks in FY87.

The CH-47 Chinook is the Army's medium-lift helicopter. Designed in the 1950's and fielded in 1962, the CH-47's primary missions are movement of ammunition, repair parts, petroleum and tactical movement of artillery, troops and special weapons on the battlefield. In 1975 a modernization program was approved to upgrade the CH-47 A, B, and C models into a new D model configuration. These improvements extended the useful life of the fleet beyond the year 2000.

*CH-47: Army's workhorse*

*CH-47D Modification Program*

Modernization includes new fiberglass rotor blades, transmission and drive system, modularized hydraulics, electrical systems, advanced flight controls, triple hook cargo system and an auxiliary power unit. These efforts greatly enhance reliability, maintainability, productivity, survivability and safety of the medium-lift fleet.

Initial operational capability was achieved on schedule in February 1984 at Fort Campbell, Kentucky. The benefits of this program to the operational units have been demonstrated by an average of 77 percent full mission capability rate (goal 70%) during the past year.

The FY 1987 budget will fund the seventh year of this effort and the third year of 48 aircraft-per-year multiyear procurement. This program continues to be a stable program with deliveries on schedule and on cost. By 31 January 1986 there will be 99 CH-47D aircraft in the field.

While other elements are essential to rapid resupply and mobility, tactical wheeled vehicles have been and will remain the backbone of our logistical system. They are vital to the fielding of new weapon systems and tactical operations Army-wide. We have a planned program to acquire tactical trucks over time to meet these needs; to fill shortages; and replace over-age, obsolete and less capable vehicles.

*Truck Shortage*

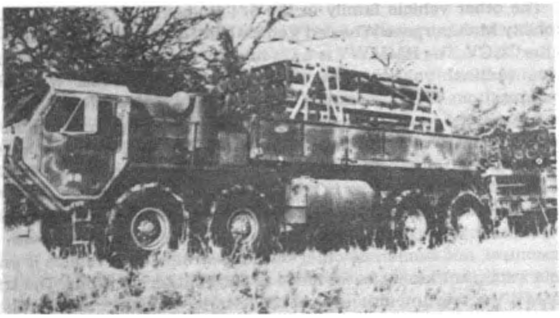
*5-Ton Truck*

*5-Ton Trucks for new systems and to replace over-age fleet*

Heading the list of workhorses is the 5-Ton Truck. It supports the introduction of such major systems as the Patriot, Pershing II, and TACFIRE, as well as meeting ammunition, general cargo transport, and other special-pur-pose needs. In FY81, a competitively awarded 5-year multi-year contract was signed with AM General Corporation for 11,394 product improved 5-Ton Trucks, with an option to increase production by 100%. To meet critical Army requirements, as well as other Services' requirements, the options have been exercised. A competitive 5 year multiyear procurement will be awarded 3QFY86. As of December 1985, over 13,500 new 5-ton trucks have been accepted by the Army. Additionally, in 1987, we will begin prototype evaluation of a Family of Medium Tactical Vehicles to replace the 2 1/2 and 5-ton fleets that will be lighter and more air transportable, mobile, and fuel efficient. We plan to begin buying this new truck in the early 1990's.

*10-Ton Trucks for MLRS, GLCM, and Pershing II*

The Army 10-Ton Heavy Expanded Mobility Tactical Truck (HEMTT) is a vehicle that features an assemblage of commercial components. The HEMTT meets high-priority systems requirements, such as Patriot, Multiple Launch Rocket System, and tactical unit ammunition and fuel transport requirements. A competitively awarded five-year multiyear contract was signed with Oshkosh Truck Corporation in FY81. In FY87 we will continue to acquire 1523 HEMTT vehicles from the current contractor. In addition, FY 87 will be the second year of an evaluation of a follow-on Family of Heavy Tactical Vehicles which will be a follow-on to the current 10-ton HEMTT. This family will incorporate the productivity enhancements of the self-loading/unloading capabilities of a Palletized Loading System.



*10-Ton HEMTT*

*Utility Vehicles needed*

Heavy tactical wheeled vehicles are critical for the transport of heavy cargo, fuel, and ammunition, but light-load requirements dictate the need for utility trucks. Historically, this need was satisfied by the M880, commercial pickup truck series of vehicles and to some extent by the M151 1/4-ton with a 1/4-ton trailer and M561 Gama Goat, 5/4 ton. We are now beginning to fill this light-load or 5/4-ton payload requirement by two vehicle families. The first vehicle family is the Commercial Utility and Cargo Vehicle (CUCV), which serves the needs of the Army, Marine Corps, Air Force and Navy.

*Commercially available, adapt-able vehicles*

The CUCV program complies with congressional direction to commercialize at least 20 percent of the M151 1/4-ton jeep fleet. Fielding of CUCV's started in September 1983. FY85 was the last year of the 4-year multiyear procurement. Over 50,000 CUCVs have been fielded.

*HMMWV*

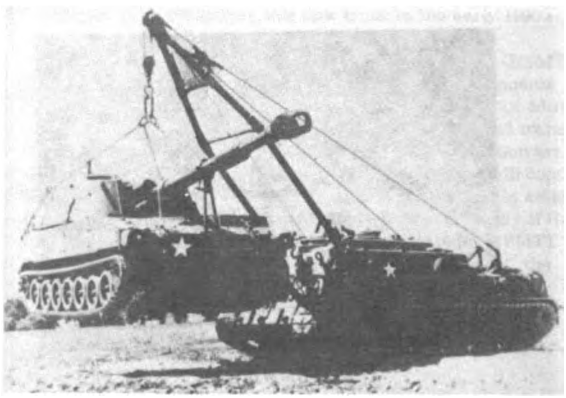
*HMMWV: asset in creating lighter divisions*

The other vehicle family in the 5/4-ton-payload category, is the High Mobility Multipurpose Wheeled Vehicle (HMMWV), which is complementary to the CUCV. The HMMWV is a 5/4-ton-payload, diesel-powered, four-wheel-drive tactical vehicle that uses a common chassis with six body configurations: TOW weapons carrier, utility, ambulance, squad carrier, shelter carrier, and Stinger weapon carrier. Emphasizing the use of commercially available components, the versatile HMMWV has excellent on-and off-road capability, with a range of 300 miles. This vehicle will replace aging and obsolete vehicles in the light tactical fleet: the M561 GAMA GOAT, the M274 MULE, and M151 1/4-ton utility vehicles not replaced by the CUCV. It will perform in command and control, utility, forward observer, forward air control, and numerous other battlefield roles. This vehicle is one of our most important assets as we move toward lighter divisions. The tri-service HMMWV program also allows the Services to take advantage of the commercial production base. The FY87 budget includes money for 12,842 HMMWVs.

Our challenge for the future is to maintain the stability of our program funding to meet existing, critical truck needs. The introduction of the families of vehicles concept will meet these needs with the operational and logistic benefits of commonality. An additional and important consideration is the logistics standardization that occurs among all the Services as a result of multiyear buys of common-use tactical vehicles. It's good for industry and good for the Armed Services.

*Armored recovery vehicle supports quantitative strength*

Rounding out our combat service support transport requirement is the M88A1 recovery vehicle. The M88A1 supports the mechanized and armored combat soldier by recovering disabled tanks and other tracked combat vehicles from the battlefield.



*M-88A1 Recovery Vehicle*

Fielding of the M88A1 was initiated in 1977. A depot program to overhaul 863 gasoline-driven M88's and to convert them to diesel power was completed in FY82. Production of the M88A1 is scheduled to continue through FY86. The FY87 budget provides funding to develop and procure product improvements to the M88A1. These product improvements will upgrade the M88A1 to provide it with the capability to fully support the M60A3, M1, and M1A1 tank fleets.

Logistical support equipment gives our soldiers the vital support they need to fight successfully in sustained conflicts. In FY87, we will place greater emphasis on logistics research and development to enhance the operational capability, reduce the maintenance burden and extend mission reliability of our equipment. Logistics research and development and logistics support equipment requires continued support.

Now that we have reviewed the mission areas that put combat power on the battlefield and sustain it in battle, we shall turn to the mission area that is essential for orderly execution of all battlefield missions—command, control, and communications.

# COMMAND, CONTROL AND COMMUNICATIONS

The command and control of our forces, and the communications which make it possible, are the keys to success on the battlefield. The C3 function is analogous to the central nervous system of the body. The weapons and support systems discussed earlier are similar to muscles which react only on command and which function effectively only when they are controlled and coordinated. The systems discussed in the C3 mission area provide the means by which we control, direct, and coordinate our forces. The importance of these systems cannot be overstated.

*Enormous demands and challenges*

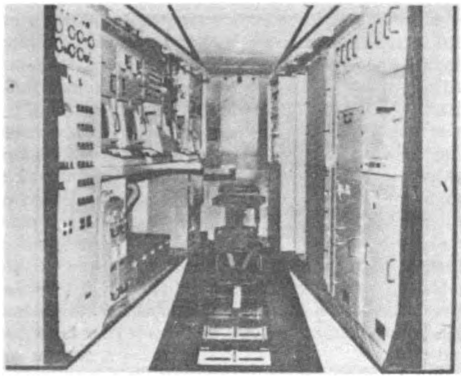
The C3 mission area encompasses a staggering variety of demands and challenges. The demands range from a derivative of the Presidential "Hot Line," down to a simple squad radio capable of functioning under the rigors of combat. The challenges relate to an almost unbelievable number of conditions and complications. C3 systems are affected by natural and man-made interference and they are subject to enemy interruption, direction finding and jamming. Many C3 systems must be compatible with the sophistication of fixed site operations in peacetime and provide mobile capability during hostilities. In addition, C3 systems must usually be compatible and interoperable with our sister Services and NATO allies.

Communications technology is a field in which the US possesses a degree of expertise that is the envy of the world. Due to affordability constraints, however, the Army's C3 equipment has not kept pace with this technology advantage. The situation is getting better because of the increased emphasis on C3 at all levels and the many modernization initiatives being pursued. With your support we will close the technology gap during the decade of the 1980's and will move from an era of grease pencils and manual switchboards to one in which the readiness of the Army's C3 systems will be significantly improved by the systems we will now discuss.

*TRI-TAC*

The Army recently reassessed its communications architecture to insure that it was purchasing the correct mix of equipment to efficiently and effectively meet its battlefield needs. The major program included in this review was the Joint Tactical Communications (TRI-TAC) program, a Joint Service and DoD program to develop and field tactical multichannel switched communications. The broad goals of the TRI-TAC program are to achieve interoperability between Army and other DOD telecommunications systems, provide new equipment that reflects the most recent technology, eliminate duplication in development among the Services, and enhance interoperability

with NATO systems.



*TRI-TAC*

*Analog to digital communications*

The TRI-TAC family of equipment consists of Mobile Subscriber Equipment (MSE), automated digital telephone and message switches, secure and nonsecure telephones, multichannel radio transmission equipment, automated control facilities, tactical data and facsimile terminals, and other associated items. This equipment is urgently needed to replace the obsolete, nonsecure, manpower-intensive, manual communications equipment currently in the field.

The MSE is the most important communications system in the FY87 request; it provides corps and division commanders with the secure, flexible, mobile communications needed for command and control on the modern battlefield. This year's request procures equipment for the first operational corps and division units which will be located at Ft Hood, Texas. The MSE acquisition is an example of an innovative approach which shortens the acquisition cycle by using a nondevelopmental strategy. It is based on a willingness to take advantage of existing, proven technology and developments by our NATO allies rather than trying to develop the "ultimate" system. It enables the Army to avoid millions in development costs and start fielding a capability in 1988 rather than in the mid- 1990's.

The FY87 request provides funding for continued software development for various TRI-TAC items and the procurement of transmission equipment, unit level switches, automated control facilities, and various voice and data terminal devices together with associated communications security equipment.

*SINCGARS*

The Army does not presently have a tactical net radio system capable of operating in an electronic countermeasure environment. The Single Channel Ground and Airborne Radio System, (SINCGARS) will give the soldier a reliable, jam-resistant, secure combat net radio system capable of operating on the move and compatible with current vehicular radios and associated communications security equipment. The FY87 budget request continues the production of this urgently needed combat radio.

*SINCGARS: reliable radio system for the soldier*

*PLRS*

Any future conflict will require combat commanders to rapidly and precisely locate and identify their own forces, as well as other friendly units, on a highly mobile and extended battlefield. The Position Location Reporting System (PLRS), a joint program with the US Marine Corps, will give us that capability. It is cryptosecure, highly resistant to jamming and can be used in all weather and terrain. In the future, PLRS will be integrated with the Joint Tactical Information Distribution System (JTIDS) terminal to form the Army Data Distribution System (ADDS). It will provide the Army with a reliable, jam resistant, data communications, navigation, and identification system for use in the five primary functional areas which require C3 on the battlefield: maneuver control, fire support, air defense, electronic warfare/intelligence, and combat service support. We consider attainment of this capability a high priority for successful combat operations. Hence, the Army and Marine Corps initiated production of PLRS under a multiyear production contract in FY83 which will result in initial system fielding of PLRS for the Army in 1987.

*Knowing where we are—PLRS a combat necessity*

For the Army, the PLRS production contract establishes a production base for the follow-on ADDS system. Hence, the FY87 request also provides for continued production of ADDS through modification of PLRS production equipment and initial procurement of JTIDS. This request will result in initial system fielding of ADDS in 1988.

*Maneuver Control System*

The commander must be able to aggregate volumes of information emanating from many sources in the form of reports, staff estimates, plans and orders. An automated command and control (C2) system is needed to provide a comprehensive, timely picture of the battlefield to support the decision making process. The Maneuver Control System (MCS) is such a system; it is a combination of computer hardware and C2 software that gives the tactical commander quick access to near real-time battlefield information. The MCS is the maneuver and force level control system within the Army Command and Control System (ACCS). As such it will be compatible and interoperable with the other control nodes for Air Defense, Fire Support, Intelligence and Electronic Warfare, and Combat Service Support. Critical elements of information from all the ACCS nodes will be instantly available to the force commander. Once a decision is made, MCS automates the preparation and distribution of orders to subordinate units for execution. A key feature of the program is its evolutionary implementation that began with an initial maneuver control capability in Europe in FY81. Both MCS software and hardware have evolved according to pre-planned, time-phased steps, guided by field user feedback from numerous exercises in Europe. Over the next several years, MCS evolution will continue. The hardware configuration will evolve into a mix of fully militarized equipment for use in critical locations and and severely stressed environments, and nondevelopmental items (NDI) employed in less critical locations and less severe environments. The MCS will achieve initial operating capability in 4th quarter FY86.

*Maneuver Control System*

Tactical Satellite Communication (TACSATCOM) systems support the ground mobile forces of the Army, Navy, Air Force, and Marine Corps by providing reliable and effective communications between widely dispersed and rapidly moving forces. Each of the systems uses a communications satellite as a relay station between terminals. Terrain is therefore less of a constraint for employment of TACSATCOM systems than for regular terrestrial systems.

*TACSATCOM*

Presently, one multichannel system and two single-channel systems are being fielded. The single-channel systems operate in the ultra high frequency range. Production of the single-channel Special Communications System, AN/MSC-64 which provides secure command and control communications from the National Command Authority to special weapons units worldwide was completed in 1983. The FY87 requests provides for completion of a super high frequency single channel receiver upgrade to improve the system survivability. Deliveries of a UHF manpack began in January 1984. The FY87 request will continue procurement of UHF manpack satellite terminals for use by Special Forces and Rangers. The Multichannel Initial System, AN/TSC-93A and AN/TSC-85A, provides tactical satellite communications down to brigade level. Production deliveries of these terminals commenced in FY85. Production of our anti-jam control modem to provide ECCM protection for this multichannel system also began in FY85.

*Ground station to brigade level and below*

To meet the severe Electronic Warfare (EW) threat and potential nuclear warfare environment of the future, a single-channel Extremely High Frequency (EHF) system will be fielded. The Single Channel Objective Tactical Terminal (SCOTT) system will provide such a jam-resistant, survivable satellite communication link. Advanced development was completed in 1983. SCOTT is the Army and other services ground terminal in the MILSTAR Satellite Communications System. During FY85, the Scott program was restructured to complete engineering development with the

*SCOTT meets electronic warfare threat*

goal of minimizing cost, schedule and technical risks. The FY87 request continues this development.

*DSCS*

The Defense Satellite Communications System (DSCS) is a worldwide military satellite communications system which supports the Worldwide Military Command and Control System (WWMCCS), the Diplomatic Telecommunications System, and tactical/strategic C3I requirements of the Military Departments. It is the only capability in existence to satisfy strategically critical wideband command, control, and intelligence communications.

The DSCS is a joint program with the Air Force responsible for the space segment and the Army for the ground subsystem. In the past few years, the Army has initiated upgrade and modernization efforts that will result in the development, procurement, and worldwide installation of a new generation of large, medium, and small satellite terminals. These terminals will be equipped with digital communications and antijam equipment. A new automated system that will control the DSCS satellites communications payload in orbit, as well as communications that pass through the satellite, is being developed. The FY87 request supports these modernization and survivability programs.

*NAVSTAR GPS: a common reference system for all services worldwide*

The NAVSTAR Global Positioning System (GPS) is a satellite-based radio position navigation system that provides users with rapid data about position, velocity, and time. When fully deployed, the system will consist of 18 satellites and thousands of user terminals.

The GPS employment includes units that normally operate at great distances from their home bases, such as cavalry, pathfinders, and Special Forces, as well as selected users to include all Army aircraft throughout the theater Army. It will also serve as an "initializer" for other position/navigation systems.

The joint GPS Program Office is staffed by Army, Navy, Air Force and NATO personnel, with the Air Force as lead. The Army is participating in the joint development of a family of manpack, vehicular, and aircraft user terminals. Testing of the first Army user terminals began in 1984.

FY87 AIRCRAFT PROCUREMENT, ARMY

| SSN | ITEM NOMENCLATURE | FY85 | FY86 | FY87 | FY88 |
|---|---|---|---|---|---|
| | FIXED WING | | | | |
| A02700 | C-12 CARGO AIRPLANE | 24.0 | 12.0 | | |
| A02000 | GUARDRAIL/COMMON SENSOR ROLL | | | | 3.3 |
| A02005 | RC-12D RECON AIRPLANE | 89.3 | | | 72.1 |
| | FIXED WING TOTAL | 113.3 | 12.0 | 0.0 | 75.4 |
| | ROTARY | | | | |
| A03400 | CH-47 CARGO HELICOPTER (CHINOOK) | 110.0 | | | |
| A04300 | EH-60A HELICOPTER (QUICKFIX) | 97.6 | 104.6 | 135.0 | |
| A04300 | EH-60A HELICOPTER (QUICKFIX) ADV PROC | 30.4 | 24.4 | 16.9 | |
| A06605 | AH-64 ATTACK HELICOPTER (APACHE) | 1159.2 | 1087.8 | 1189.3 | |
| A06605 | AH-64 ATTACK HELICOPTER (APACHE) ADV PROC | 87.6 | 55.3 | 39.1 | |
| A05002 | UH-60A BLACK HAWK (MYP) | 271.0 | 210.9 | 155.4 | 336.6 |
| A05002 | UH-60A BLACK HAWK (MYP) ADV PROC | 171.8 | 199.0 | 195.0 | 191.4 |
| | ROTARY TOTAL | 1927.6 | 1682.0 | 1730.7 | 1419.1 |
| | MODIFICATIONS | | | | |
| AZ3530 | OV-1 MOHAWK SURVEILLANCE AIRPLANE | 24.9 | 22.7 | 24.9 | 39.3 |
| AZ2000 | RC12-D RECON AIRPLANE | 6.2 | | | |
| AZ2100 | RV-1 RECON AIRPLANE | 4.7 | | 2.7 | 5.4 |
| AA0150 | AH1S ATTACK HELICOPTER (COBRA-TOW) | 70.3 | 128.9 | 61.0 | 81.0 |
| AA6605 | AH-64 MODS | | | 33.4 | 33.0 |
| AA0250 | CH-47 CARGO HELICOPTER (MYP) | 231.5 | 219.0 | 208.4 | 173.9 |
| AA0250 | CH-47 CARGO HELICOPTER (MYP) ADV PROC | 159.9 | 124.8 | 58.6 | 69.2 |
| AA0300 | CH-54 CARGO HELICOPTER (TARHE) | | .5 | 1.3 | 10.3 |
| AZ1200 | EH-1 ELECTRONIC HELICOPTER (Q-FIX MOD) | 3.7 | | | |
| AA0400 | OH-58 OBSERVATION HELICOPTER (KIOWA) | 48.8 | | | |
| AA0600 | UH-1 UTILITY HELICOPTER (IROQUOIS) | 6.5 | 11.7 | 6.3 | 18.8 |
| AA0490 | UH-60 BLACKHAWK MODS | 15.8 | 13.6 | 7.7 | 18.8 |
| AZ2200 | ARMY HELO IMPROVEMENT PROGRAM (AHIP) | 161.0 | 166.6 | 164.9 | 113.2 |
| AZ2200 | ARMY HELO IMPROVEMENT PROGRAM ADV PROC | 47.2 | 20.9 | 45.4 | 129.1 |
| AZ3900 | AIR TO AIR STINGER ACFT MOD | | | 28.8 | 41.5 |
| AA0700 | AIRBORNE AVIONICS | 9.5 | 1.0 | .1 | 1.9 |
| AA0720 | ASE MODIFICATIONS CLOSE COMBAT | | | 3.5 | .1 |
| AA0725 | MODIFICATIONS UNDER $2.0M (AIRCRAFT) | 1.1 | .1 | .1 | 2.6 |
| AZ3405 | ACFT WW | 66.9 | 16.3 | 12.0 | 24.4 |
| Z3407 | SOF AIRCRAFT MODIFICATIONS | | | 3.5 | 67.0 |
| | MODIFICATIONS TOTAL | 857.9 | 726.1 | 662.6 | 829.5 |
| | SPARES AND REPAIR PARTS | | | | |
| AA0950 | SPARE PARTS | 677.7 | 814.3 | 710.5 | 786.9 |
| | SPARE PARTS TOTAL | 677.7 | 814.3 | 710.5 | 786.9 |
| | GROUND SUPPORT AVIONICS | | | | |
| AZ3504 | AIRCRAFT SURVIVABILITY EQUIPMENT | | | 11.6 | 88.5 |
| | GROUND SUPPORT AVIONICS TOTAL | 0.0 | 0.0 | 11.6 | 88.5 |

FY87 AIRCRAFT PROCUREMENT, ARMY

| SSN | ITEM NOMENCLATURE | FY85 | FY86 | FY87 | FY88 |
|---|---|---|---|---|---|
| | OTHER SUPPORT | | | | |
| AZ3000 | AVIONICS SUPPORT EQUIPMENT | 53.7 | 65.0 | 57.9 | 80.4 |
| BA9999 | HELIBORNE C2 CONSOLE | | | | 2.3 |
| AZ3020 | MLS AVIONICS | | | | 7.6 |
| AZ3100 | COMMON GROUND EQUIPMENT | 15.6 | 33.5 | 28.4 | 29.7 |
| AA0050 | AIR TRAFFIC CONTROL | 8.9 | 9.0 | 4.8 | 2.9 |
| AZ3800 | SYNTHETIC FLIGHT TRAINING SYSTEMS | 156.3 | 117.1 | 37.7 | 61.5 |
| AZ3300 | INDUSTRIAL FACILITIES | 39.2 | 59.3 | 16.0 | 22.8 |
| A50100 | WAR CONSUMABLES | 3.6 | 5.9 | 4.5 | 4.2 |
| | OTHER SUPPORT TOTAL | 277.4 | 289.8 | 149.3 | 211.4 |
| | ARMY AIRCRAFT APPROPRIATION TOTAL | 3853.8 | 3524.2 | 3264.7 | 3410.8 |

FY87 MISSLE PROCUREMENT, ARMY

| SSN | ITEM NOMENCLATURE | FY85 | FY86 | FY87 | FY88 |
|---|---|---|---|---|---|
| | SURFACE-TO-AIR MISSLE SYSTEM | | | | |
| C22100 | CHAPARRAL | 31.0 | 54.9 | 103.7 | 114.5 |
| CC2100 | NON LINE OF SIGHT AIR DEFENSE SYSTEM | | | | 14.2 |
| CC2200 | AIR DEFENSE SYS HEAVY | | | 9.1 | 65.4 |
| CC2300 | AIR DEFENSE DIV SYSTEM LIGHT | | | | |
| CA0275 | OTHER MISSLE SUPPORT | 8.3 | 5.0 | 6.5 | 4.7 |
| C49100 | PATRIOT (MYP) | 958.8 | 928.1 | 951.5 | 912.7 |
| C49100 | PATRIOT (MYP) ADV PROC | | | 45.3 | 40.1 |
| C18500 | STINGER (MYP) | 207.3 | 246.6 | 251.7 | 337.7 |
| C18500 | STINGER (MYP) ADV PROC | | | 40.3 | 45.5 |
| | SURFACE-TO-AIR SYSTEM TOTAL | 1205.4 | 1234.6 | 1408.1 | 1609.5 |
| | AIR-TO-AIR MISSLE SYSTEM | | | | |
| C70000 | LASER HELLFIRE SYSTEM | 224.0 | 223.2 | | 190.6 |
| | AIR-TO-SURFACE MISSLE SYSTEM TOTAL | 224.0 | 223.2 | 0.0 | 190.6 |
| | ANTI-TANK/ASSAULT MISSILE SYSTEM | | | | |
| C59300 | TOW 2 | 184.0 | 160.9 | 134.6 | 176.3 |
| C59300 | TOW 2 ADV PROC | 16.2 | 22.0 | 15.5 | |
| C76500 | PERSHING | 370.0 | 224.5 | 31.8 | |
| C67600 | MULTIPLE LAUNCH ROCKET SYSTEM (MYP) | 371.6 | 468.9 | 474.2 | 480.2 |
| C67600 | MULTIPLE LAUNCH ROCKET SYSTEM ADV PROC | 137.4 | 41.0 | | |
| | ANTI-TANK/ASSAULT MISSLE SYSTEM TOTAL | 1079.2 | 917.3 | 656.1 | 663.5 |
| | MODIFICATIONS | | | | |
| C50700 | PATRIOT | 11.8 | 16.5 | 38.6 | 52.8 |
| C24200 | CHAPARRAL | 93.8 | 106.7 | 5.2 | 13.5 |
| C35200 | HAWK | 55.6 | 46.9 | 68.2 | 50.5 |
| C61700 | TOW | 31.0 | 16.9 | 53.0 | 38.9 |
| C57300 | DRAGON | | | 4.7 | |
| C76200 | LANCE MODIFICATIONS | | | 3.8 | 16.1 |
| C97500 | LCSS | 3.8 | | | |
| C92800 | PERSHING MODIFICATIONS | 3.0 | | | 10.1 |
| C54000 | AN/TSQ-73 | 11.4 | | | |
| | MODIFICATIONS TOTAL | 210.4 | 187.0 | 173.5 | 181.9 |
| | SPARES AND REPAIR PARTS | | | | |
| CA0250 | SPARES AND REPAIR PARTS | 244.8 | 286.8 | 150.9 | 301.3 |
| | SPARES AND REPAIR PARTS TOTAL | 244.8 | 286.8 | 150.9 | 301.3 |
| | SUPPORT EQUIPMENT AND FACILITIES | | | | |
| C93000 | AIR DEFENSE TARGETS | 30.4 | 19.8 | 32.4 | 31.6 |
| CL2000 | ITEMS LESS THAN $2.0M (MISSILES) | 6.6 | 3.7 | 1.5 | 2.2 |
| CA0100 | PRODUCTION BASE SUPPORT | 56.5 | 29.9 | 15.7 | 17.7 |
| CA4600 | OTHER PRODUCTION CHARGES | 38.6 | 2.0 | | |
| | SUPPORT EQUIPMENT AND FACILITIES TOTAL | 132.1 | 55.4 | 49.6 | 51.5 |
| ARMY MISSLE PROCUREMENT APPROPRIATION TOTAL | | 3095.9 | 2904.3 | 2438.2 | 2998.3 |

PROCUREMENT WEAPONS AND TRACKED COMBAT VEHICLES, ARMY

| SSN | ITEM NOMENCLATURE | FY85 | FY86 | FY87 | FY88 |
|---|---|---|---|---|---|
| G02202 | MORTAR, 81MM, M252 | 11.3 | 5.7 | 10.1 | 10.5 |
| G03000 | MORTAR, 120MM | | 5.0 | 13.2 | 22.4 |
| G14900 | M16 RIFLE | 36.6 | 35.0 | 36.8 | 38.8 |
| G15300 | PERSONAL DEFENSE WEAPON, 9MM | 9.1 | 7.5 | 4.4 | 5.1 |
| G21100 | VEH RAPID FIRE WPN SYS-BUSHMASTER (MYP) | 39.1 | 31.9 | 37.3 | 38.0 |
| G21100 | VEH RAPID FIRE-BUSHMASTER ADV PROC | 3.0 | 8.3 | 3.2 | 2.2 |
| G21400 | TANK MUZZLE BORESIGHT DEVICE | 3.2 | 4.0 | | |
| | WEAPONS AND OTHER COMBAT VEHICLES TOTAL | 135.9 | 249.5 | 175.4 | 212.0 |
| | MODIFICATION OF WEAPONS AND OTHER COMBAT VEHICLES | | | | |
| GZ2800 | M16A1 RIFLE MODS | | 3.3 | 3.3 | 3.5 |
| GC0925 | MODIFICATIONS UNDER $2.0M (WOCV-WTCV) | .9 | 2.5 | 4.0 | 4.8 |
| | MODIFICATIONS OF WEAPONS/OTHER VEHICLES | .9 | 5.8 | 7.3 | 8.3 |
| | SUPPORT EQUIPMENT AND FACILITIES | | | | |
| GC0150 | SPARES AND REPAIR PARTS (WOCV-WTCV) | 22.0 | 28.6 | 17.6 | 28.0 |
| GL3200 | ITEMS LESS THAN $2.0M (WOCV-WTCV) | 4.3 | 2.9 | 3.3 | 3.4 |
| GC0050 | PRODUCTION BASE SUPORT (WOCV-WTCV) | 52.2 | 40.2 | 37.0 | 43.5 |
| GC2701 | CANNON TUBE FORGINGS FOR SURGE | | | 9.6 | |
| | SUPPORT EQUIPMENT AND FACILITIES TOTAL | 78.5 | 71.7 | 67.5 | 74.9 |
| | ARMY WEAPONS AND TRACKED COMBAT VEH TOTAL | 4271.1 | 4676.8 | 4452.6 | 4946.1 |

## AMMUNITION PROCUREMENT, ARMY

| SSN | ITEM NOMENCLATURE | FY85 | FY86 | FY87 | FY88 |
|---|---|---|---|---|---|
| | **ATOMIC MATERIEL** | | | | |
| EA0050 | NUCLEAR WEAPONS SUPPORT MATERIEL | 11.8 | 3.4 | 2.6 | 2.4 |
| E82700 | PROJ, NUCLEAR, 155MM | | | 11.7 | |
| | ATOMIC MATERIEL TOTAL | 11.8 | 3.4 | 14.3 | 2.4 |
| | **CONVENTIONAL AMMUNITION** | | | | |
| E00701 | CTG, 5.56MM, BALL M193 | 7.7 | 10.1 | 15.0 | 10.9 |
| E00702 | CTG, 5.56MM, TRACER | | | 5.6 | 6.8 |
| E00703 | CTG, 5.56MM, TRACER CLIP | | | 4.8 | .9 |
| E01100 | CTG, 5.56MM, BLANK M200 | 14.4 | 10.0 | 7.0 | 22.3 |
| E01101 | CTG, 5.56MM, BLK M200, LKD F/SAW | 4.9 | 2.2 | 18.4 | 6.5 |
| E04600 | CTG, 5.56MM, 4 BALL M855/1 TRCR M856 LKD | 7.9 | 9.6 | 29.4 | 36.3 |
| E04601 | CTG, 5.56MM, BALL M16-A2 | 10.1 | 25.0 | 3.4 | 26.5 |
| E04602 | CTG, 5.56MM, TRACER M16-A2 | 1.7 | 6.5 | | 8.9 |
| E02002 | CTG, 7.62MM, 4 BALL M80/1 TRCR M62 LKD | 22.9 | 25.8 | 68.5 | 81.3 |
| E02003 | CTG, 7.62MM, BALL M80 LKD/M13 | | .7 | 2.7 | 4.7 |
| E02007 | CTG, 7.62MM, LKD 4 BALL ITRACER OHF | | 2.0 | .5 | 2.8 |
| E01902 | CTG, 7.62MM, BLANK M82 LKD/M13 | | | 15.9 | 11.2 |
| E05700 | CTG, CAL .45, BALL M1911 | .7 | 2.2 | .7 | 1.2 |
| E07000 | CTG, CAL .50, PLASTIC LKD 4 BALL/ 1 TRCR | | | 5.4 | 2.8 |
| E0640[illegible] | CTG, CAL .50, LKD 4 BALL/1 TRCR W/M15A2LK | 10.9 | 11.3 | 9.6 | 12.0 |
| E06800 | CTG, CAL .50, APIT, M20 LKD | | 1.4 | 4.0 | 5.3 |
| [illegible]00 | CTG, CAL .50, BALL LKD | | 3.8 | 2.5 | 4.7 |
| E07302 | CTG, CAL .50, BLK, M1A1, LKD W/M9LK F/M2 | 19.5 | | | 12.6 |
| E07303 | CTG, CAL .50, BLK M1A1, LKD F/M85MG (MYP) | | | | 2.9 |
| E07700 | CTG, .50 CAL, LKD TRACER M17 | 3.2 | | | |
| E07200 | CTG, CAL .50, LKD 4 BALL/1 TRCR W/M9 LK | | 48.0 | 22.9 | 34.8 |
| E08904 | CTG, 20MM, LKD TP-T M220 SERIES MLB M14A2 | 4.2 | 7.9 | 9.7 | 7.9 |
| E08902 | CTG, 20MM, LKD 4 TP M55A2/1TP-T M220 | | | 3.3 | 5.0 |
| E08201 | CTG, 25MM, HEI-T M792 W/F | 40.8 | 24.9 | 48.7 | 57.6 |
| E08202 | CTG, 25MM, APDS-T M791 W/M28(MYP) | 49.6 | 11.1 | | |
| E08203 | CTG, 25MM, TPT LKD M793 MLB M28 | | 41.2 | 25.5 | 18.5 |
| E09900 | CTG, 30MM, LKD HEDP M789 W/FUZE | 22.9 | 5.0 | | |
| E10100 | CTG, 30MM, LKD PT M788 | 7.7 | 9.3 | 2.4 | 2.1 |
| E11800 | CTG, 40MM, HEDP M430 | 17.0 | 43.5 | 28.7 | 49.0 |
| E71100 | CTG, 40MM, TP F/MK19 | | 4.8 | 7.5 | 8.0 |
| E13300 | CTG, 40MM, GREEN STAR PARACHUTE | | | | 3.9 |
| E13800 | CTG, 40MM, PRAC M781 | 5.1 | 4.6 | 3.6 | 7.6 |
| E11300 | CTG, 40MM, RED SMOKE MARKER | | | 1.8 | 3.9 |
| E11400 | CTG, 40MM, GREEN SMOKE MARKER | | | 1.9 | 3.9 |
| E11500 | CTG, 40MM, YELLOW SMOKE MARKER | | | 1.9 | 4.1 |
| E12100 | CTG, 40MM, WHITE STAR CLUSTER M585 F/LCHR | | | | 2.7 |
| E12400 | CTG, 40MM, RED STAR, PARACHUTE | | | | 3.8 |
| E15200 | CTG, 75MM, BLANK, M337A1 F/HOWITZER | | 2.8 | | |
| E76100 | CTG, 81MM: ILLUM XM853 | | 7.5 | 3.4 | 2.9 |
| E18403 | CTG, 81MM: HE, M821 W/FUZE M734 MO | 67.8 | 47.7 | 91.3 | 23.5 |
| E76200 | CTG, 81MM: SMOKE, RP, XM819 | | 6.2 | 11.0 | 11.8 |
| E69601 | CTG, 81MM: FULL RANGE, PRACTICE, XM879 | 7.9 | | | |
| E19800 | CTG, 81MM: 1/10 RNG, PRAC, XM880 | | 2.4 | 2.9 | 2.4 |

AMMUNITION PROCUREMENT, ARMY

| SSN | ITEM NOMENCLATURE | FY85 | FY86 | FY87 | FY88 |
|---|---|---|---|---|---|
| E25100 | CTG, 4.2-IN HE M329A2 W/O FUZE | 18.4 | 32.4 | 22.0 | |
| E25501 | CTG, 120MM: HE, XM933, W/FUZE M734 MO | | | 44.7 | 42.6 |
| E25503 | CTG, 120MM: ILLUM, XM930 | | | 5.5 | 5.6 |
| E25504 | CTG, 120MM: SMOKE, XM929 | | | 14.3 | 14.2 |
| E23900 | CTG, 105MM, HEAT MP T M456A2 | 45.0 | 41.6 | 7.7 | |
| E24000 | CTG, 105MM,TP-T, M490 | 39.3 | 32.1 | | 17.3 |
| E67902 | CTG, 105MM, TRACE-P FOR M833 | 5.7 | 2.3 | | |
| E22100 | CTG, 105MM, DS-TP M724 | 80.8 | 89.4 | 41.6 | 42.2 |
| E67901 | CTG, 105MM, APFSDS-T M833 | 46.4 | 42.3 | 20.3 | 36.9 |
| E73100 | CTG, 120MM APFSDS-T M829 | 41.7 | 132.0 | 75.9 | 89.6 |
| E73200 | CTG, 120MM HEAT-MP-T, M830(MYP) | 33.2 | 42.1 | 27.8 | 17.9 |
| E73300 | CTG, 120MM TP-TM831 (MYP) | 40.4 | 39.6 | 38.8 | |
| E73400 | CTG, 120MM TPCSDS-T, M865(MYP) | 62.6 | 65.0 | 104.9 | 123.2 |
| E28100 | PROJ, 155MM, HE, ICM M483 | 246.9 | 269.8 | 173.0 | 91.3 |
| E67800 | PROJ, 155MM, SMK, WP, M825 | 12.5 | 13.1 | 13.5 | 10.9 |
| E67100 | PROJ, 155MM, HE ADAM M692 | 32.0 | | | |
| E67200 | PROJ, 155MM, HE, ADAM M731 | 34.9 | 20.6 | 33.9 | 28.0 |
| E67500 | PROJ, 155MM, HE, RAAMS M718 | | | 11.9 | 8.9 |
| E67502 | PROJ, 155MM, HE RAAMS M741 | 100.9 | 75.1 | 105.4 | 37.1 |
| E68500 | PROJ, 155MM, BASEBLEED, XM864 | | | 31.6 | 71.7 |
| E67600 | PROJ, 155MM, HE COPPERHEAD (EA) | 200.8 | 219.1 | 8.2 | 190.1 |
| E28001 | PROJ, 155MM, CHEM GB-2 | | 21.7 | 60.6 | |
| E27201 | CHARGE, PROPELLING, M155MM GREEN BAG M3 | 32.4 | 12.2 | 38.0 | 6.1 |
| E27301 | CHARGE, PROPELLING, M155MM, WHITE BAG, M4 | 30.0 | | | |
| E27303 | CHARGE, PROPELLING, M155MM, RED BAG M203 | | 20.4 | 20.0 | 37.6 |
| E27100 | CHARGE, PROPELLING, M155MM, RED BAG M119 | 120.4 | | 55.6 | 46.9 |
| E6700 | PROJ, 8-INCH, HE ICM (DP), M509 | 129.5 | 50.0 | | |
| E66600 | PROJ, 8-INCH, HE, RAP, M650 | 15.4 | 26.0 | 37.3 | 33.4 |
| E29202 | CHARGE, PROPELLING, 8-INCH WB, M188 | 64.7 | | 4.0 | |
| E62704 | FUZE, PROXIMITY, M732 | | | | 16.7 |
| E62208 | FUZE, PD M739/M739A1 | 3.6 | | | |
| E61302 | FUZE, MTSQ M577/M577A1 | 50.8 | 49.3 | 11.7 | 21.4 |
| E61503 | FUZE, MTSQ M582/M582A1 | 4.8 | 10.5 | 11.2 | 1.6 |
| E63000 | PRIMER, PERC, M82 | | 2.9 | 1.8 | 1.4 |
| E40601 | GROUND IMP MINE SCAT SYS AP M74 (MYP) | 19.5 | | | |
| E40602 | GROUND IMP MINE SCAT SYS AT M75 (MYP) | 39.2 | | | |
| E72194 | CANISTER MINE (VOLCANO) PRACTICE XM88 | | | 1.9 | 3.0 |
| E72195 | CANISTER MINE (VOLCANO) XM87 | | | 31.6 | 31.2 |
| E76900 | MTR RKT 5 IN MK22 MOD4 | 4.0 | 11.4 | 13.3 | 9.3 |
| E75100 | LINE CHARGE M58A3 (MCLIC) | 12.5 | 22.3 | 24.4 | 17.9 |
| E71200 | MODULAR MINE PACK SYSTEM | 15.1 | | 23.4 | 36.2 |
| E77100 | PURSUIT DETERRENT MUNITION | | | 2.1 | |
| E55400 | DEMOLITION MUNITIONS & OTHER | 18.4 | 16.5 | 13.7 | 17.1 |
| E50700 | DEMO KIT BANGALORE TORPEDO | | 3.0 | | |
| E53400 | RETROFIT, CTG 105MM HE M760 | 2.3 | | | |
| E36100 | LIGHTWEIGHT MULTI-PURPOSE WEAPON | 43.0 | 58.2 | 82.5 | 84.9 |
| E32900 | LIGHT WGT MULTI PURPOSE SYSTEM TRNR | 3.4 | 3.1 | 2.5 | 2.4 |
| E37327 | HYDRA 70 RKT, MPSM HE M261 WHD (MYP) | 33.0 | 28.9 | | |

AMMUNITION PROCUREMENT, ARMY

| SSN | ITEM NOMENCLATURE | FY85 | FY86 | FY87 | FY88 |
|---|---|---|---|---|---|
| E37309 | HYDRA 70 RKT, HE/RS (M151/M433) | | | | 12.9 |
| E37314 | HYDRA 70 RKT, ILLUM M257 WHD | | | | 6.2 |
| E37334 | HYDRA 70 RKT, MPSM PRAC M267 WHD | 5.4 | 5.4 | 2.7 | 16.6 |
| E37335 | HYDRA 70 RKT, HE/PD (M151/M423/MK66) | | 7.0 | 44.8 | |
| E34000 | GRENADE, HAND, ALL TYPES | 17.7 | 28.7 | 27.4 | 24.0 |
| E33300 | GREN SMK SCREENING RP L8A1/L8A3 | | 9.8 | 6.3 | 3.8 |
| E32500 | GRENADE, SMOKE SCREENING IR M76 | 8.2 | 11.5 | 9.0 | 4.4 |
| E46900 | SIGNALS, ALL TYPES | 25.7 | 14.9 | 18.0 | 14.4 |
| E51200 | SIMULATORS, ALL TYPES | 12.2 | 19.9 | 4.3 | 20.5 |
| | CONVENTIONAL AMMUNITION TOTAL | 2079.6 | 1927.6 | 1789.0 | 1927.0 |
| | MISCELLANEOUS | | | | |
| EB0016 | AMMO COMPONENTS/SUPPORT, ALL TYPES | 32.0 | 21.3 | 20.3 | 15.1 |
| E77000 | CAD/PAD | | .5 | 2.5 | 2.3 |
| EA0055 | ITEMS LESS THAN $2.0M (MISC-AMMO) | 10.7 | 11.0 | 5.2 | 8.3 |
| EA0650 | SPARES AND REPAIR PARTS | 1.0 | | 1.2 | 1.7 |
| EA0575 | AMMUNITION PECULIAR EQUIPMENT | .9 | 5.2 | 7.8 | 8.1 |
| E64500 | NITROGUANIDINE (LB) | 27.7 | 25.0 | 23.2 | 24.8 |
| EA0525 | COMP A-5 | | | 12.2 | 12.5 |
| EA0512 | COMP C-4 | | | 9.5 | 9.8 |
| EA0514 | PBX 0280 | | | 3.8 | 3.9 |
| EA0520 | COMP LX-14 | | | 3.8 | 4.0 |
| EA0523 | HMX EXPL-805 | | | 5.7 | 5.9 |
| EA0535 | WAR RESERVE STOCKPILING (EXPL/PROPELLANT) | 33.0 | | | |
| EA8000 | AMMO 9WW/ELT | 1.7 | 1.7 | 1.6 | 2.9 |
| | MISCELLANEOUS TOTAL | 107.0 | 64.7 | 96.8 | 99.3 |
| | PRODUCTION BASE SUPPORT | | | | |
| EP1000 | PROVISION OF INDUSTRIAL FACILITIES | 282.5 | 280.6 | 159.0 | 300.5 |
| EA0054 | COMPONENTS FOR PROVE-OUT | | 14.0 | 8.7 | 16.4 |
| EP2000 | LAYAWAY OF INDUSTRIAL FACILITIES | 19.5 | 20.5 | 22.9 | 19.7 |
| EP4000 | JEFFERSON PROVING GROUND MODERNIZATION | | 2.0 | 2.2 | |
| EP4100 | CHEMICAL DEMILITARIZATION PROGRAM | | 81.3 | | |
| EP1220 | MODERNIZATION PROJECTS | | 103.1 | 161.1 | |
| | PRODUCTION BASE SUPPORT TOTAL | 302.0 | 501.5 | 353.9 | 336.6 |
| ARMY AMMUNITION PROCUREMENT APPROPRIATION TOTAL | | 2500.3 | 2497.2 | 2254.0 | 2424.0 |

OTHER PROCUREMENT , ARMY

| SSN | ITEM NOMENCLATURE | FY85 | FY86 | FY87 | FY88 |
|---|---|---|---|---|---|
| D00200 | CHASSIS TRAILER GEN 2 1/2 TON 2W M200A1 | 5.6 | 7.6 | 4.1 | |
| D00800 | CHASSIS, TRAILER, GP, 3 1/2, 2W, M353 | | | 3.7 | |
| D01100 | DOLLY SET, TRANS SHELTER, 2 1/2T, M720 | | | | 3.3 |
| D01300 | DOLLY SET, TRANS SHELTER, 5 1/4T, M832 | | | | 3.0 |
| D00501 | DOLLY SET, TRANS SHELTER, 7 1/2T, M1022 | 3.6 | 5.5 | 6.2 | 7.8 |
| D15201 | MOTORCYCLE, GED, 2W, ROUGH TERRAIN | | 2.0 | 7.1 | 7.8 |
| D01500 | SEMITRAILER BB/CONT 22 1/2T M871 C/S | 3.5 | | | 15.9 |
| D01600 | SEMITRAILER BB/CONT 34T M872 C/S | | 3.4 | 6.4 | 7.6 |
| D01000 | SEMITRAILER, LB, 12T M270A1-M269A1 | | 9.3 | | |
| D00700 | SEMITRAILER, LOW BED, 40T M870 (C/S) | 3.2 | 12.2 | 1.9 | 15.2 |
| D02400 | SEMITRAILER, LOW BED HET, XM1000 | | | | 32.8 |
| D02300 | SEMITRAILER, TANK, 5000G | | 19.8 | 8.8 | 8.5 |
| D02700 | SEMITRAILER, TANK, 7500G, BULKHAUL | | | 7.3 | 10.3 |
| D03200 | SEMITRAILER, VAN ELECTRONIC 6T 2W M373A2 | | | | 2.0 |
| D04800 | SEMITRAILER,VAN SUPPLY 12T, 2W, M129A2C | | | 7.0 | |
| D06200 | TRAILER, CARGO 3/4T, 2W, M101A2 W/E | | 3.5 | 5.6 | 12.7 |
| D06400 | TRAILER, CARGO, 1 1/2T, 2W, M105A2 | 11.5 | 11.1 | | 18.2 |
| D05700 | TRAILER, HEAVY, EXPANDED MOBILITY | 4.7 | | 7.4 | 8.3 |
| D06800 | TRAILER TANK WATER 400G 1 1/2T, 2W M149A1 | | 4.0 | 5.9 | 18.4 |
| D15400 | HI MOB MULTI-PURP WHLD VEH (HMMWV) (MYP) | 311.1 | 313.3 | 330.6 | 128.5 |
| D11300 | COMMERCIAL UTILITY AND CARGO VEHICLE | 315.4 | | | |
| D19000 | SMALL UNIT SUPPORT VEHICLE (SUSV) | | 13.8 | 26.2 | 32.2 |
| D14000 | TRUCK, 5T, 6X6, ABT (MYP) | 347.2 | 216.8 | | 400.0 |
| D16200 | TRUCK, 10T, 8X8, ABT (MYP) | 199.6 | 116.1 | 234.3 | 70.4 |
| D15900 | TRUCK, TRACTOR, LINE HAUL, M915A1 | | | | 58.1 |
| D16000 | TRUCK, YARD TYPE, M878 (C/S) | | 3.1 | | |
| DA0925 | MODIFICATION OF IN SERVICE EQUIPMENT | .8 | 1.5 | 3.8 | 15.5 |
| G38900 | SHOP EQUIPMENT, AUTO MAINT & REPAIR | | .9 | 2.5 | 2.5 |
| DL5110 | ITEMS LESS THAN $2.0M (TAC VEH) | 3.1 | 1.7 | 1.9 | 1.4 |
| | TACTICAL VEHICLES TOTAL | 1209.3 | 745.6 | 670.7 | 880.4 |
| | **NON-TACTICAL VEHICLES** | | | | |
| D23000 | PASSENGER CARRYING VEHICLES | 28.8 | 30.0 | 13.8 | 10.8 |
| D24850 | GENERAL PURPOSE VEHICLES | 33.8 | 39.9 | 34.9 | 39.3 |
| D25000 | SPECIAL PURPOSE VEHICLES | 10.5 | 13.0 | 9.7 | 14.0 |
| | NON-TACTICAL VEHICLES TOTAL | 73.1 | 82.9 | 58.4 | 64.1 |
| | **SUPPORT EQUIPMENT AND FACILITIES** | | | | |
| DA0350 | SPARES AND REPAIR PARTS (TAC) | 121.5 | 135.0 | 136.6 | 126.5 |
| DA0400 | PRODUCTION BASE SUPPORT (TAC) | 3.2 | | | 1.8 |
| | SUPPORT EQUIPMENT AND FACILITIES TOTAL | 124.7 | 135.0 | 136.6 | 128.3 |
| | **TELECOMM EQUIP - READINESS COMMAND COMM** | | | | |
| BB5777 | JCSE EQUIPMENT (USREDCOM) | 4.7 | .3 | 1.8 | 3.7 |
| BZ9950 | CINCS INITIATIVE | | | 4.1 | 4.7 |
| BB2000 | CLASSIFIED PROJECT 9WW | 24.4 | 14.2 | 9.1 | 8.2 |
| | TELECOMM EQUIP - READINESS COMMAND TOTAL | 29.1 | 14.5 | 15.0 | 16.6 |

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and the vertical launch system (VLS) forecasted net additional costs would be incurred if these systems were dual-sourced. In actuality, to date over $1.4 billion has been saved on the Aegis program and $65 million has been saved in the VLS program from the Navy's budgeted amounts by competing these systems.

### COMPETITION AT PRIME VERSUS THE SUBCONTRACTOR LEVEL

*Question.* Does the Navy expect to make the greatest gains by competing systems at the prime contractor level or by competitions at the subcontractor/vendor level?

Answer. The Navy's greatest leverage is through prime contracts. However, the Navy expects benefits—in terms of lower costs, higher quality, and improved schedules—to come from both prime contractor and subcontractor competitions. Competitive pressures brought to bear on the prime will also flow through to the subcontractors. In procurements that are necessarily sole source, the Navy will intensify subcontractor competition.

### NAVY TOOLING POLICY

It seems to me that the cost of any contractor investment in tooling not directly charged to the government would be reflected in the price of the articles the government guys. Therefore, the government ultimately pays, albeit indirectly, for the contractor's investment.

*Question.* If this is the case, why do you think your tooling policy will result in lower prices?

Answer. The Navy policy on contractor investment in tooling and test equipment must be assessed in the context of the overall Navy acquisition policy which mandates competitive, firm fixed price contracts in almost all cases. In this context, the contractor has every incentive to keep all costs at the lowest possible levels in order to remain competitive. The tooling and test equipment purchased by a contractor is part of a company's capital budget that is reviewed at the highest levels of the company to insure that only necessary, efficient equipment is bought at the lowest possible cost. This means that in the immediate term, the Navy tooling policy results in lower prices. In addition, contractor purchase of tooling up front allows the government to use funds that would otherwise be used to pay for tooling for other purposes. In the longer term, contractor investment in tooling gives companies a bigger stake in government contractors.

Mr. STRATTON. The subcommittee will stand adjourned until 1 o'clock this afternoon.

[Whereupon, 10:55 a.m., the subcommittee recessed, to reconvene at 1 p.m., the same day.]

## AFTERNOON SESSION

## FISCAL YEAR 1987 DEPARTMENT OF THE ARMY AIR DEFENSE PROGRAMS

## STATEMENT OF HON. SAMUEL S. STRATTON, A REPRESENTATIVE FROM NEW YORK, CHAIRMAN, PROCUREMENT AND MILITARY NUCLEAR SYSTEMS SUBCOMMITTEE

Mr. STRATTON. The subcommittee will come to order.

This afternoon we will receive an update on the Army's air defense plan for fiscal year 1987. The Army is requesting $1.7 billion for air defense programs. This is the third day of billion-dollar programs that the Army is supporting. Somehow the spirit of the Gramm-Rudman legislation seems to have been lost on the Army.

The Army's history of fielding forward area air defense systems has been spotty. Since 1963, the Army has been unsuccessfully attempting to solve its short-range air defense needs. This year, the committee needs to understand and examine the framework underlying the Army's new program, the costs and potential effective-

ness of the proposed system and the reasons why these solutions may be viable.

It does seem strange that the Army, although I guess it wasn't the Army, it was the Department of Defense, should tremble before one Member of Congress who was at one time a pilot and obviously not exactly an expert in air defense. It was an air attack that he was so concerned with, and that single individual has wiped out all of the air defense for the troops that are located in Germany.

As I found out last summer, when we took a quick look to Germany, and the chief commanders in each area indicated that their major weakness and their major vulnerability was air defense.

Before we call on our major witnesses, Maj. Gen. Donald Infante, the commander of the Air Defense School, accompanied by Brig. Gen. Jerry Harrison and Brig. Gen. William Fiorentino, I would turn to our ranking Republican member, Mrs. Holt, for any comments that she might have.

**STATEMENT OF HON. MARJORIE S. HOLT, A REPRESENTATIVE FROM MARYLAND, RANKING MINORITY MEMBER, PROCUREMENT AND MILITARY NUCLEAR SYSTEMS SUBCOMMITTEE**

Mrs. Holt. Thank you. I don't have any comments. I would like to welcome the witnesses today. I think it is interesting that we are beating up on the witnesses today for coming in with a big request. In the 14 years I have been on this committee, we have been pleading with the Army to come forth and ask for something that is going to help them to do their job better, to really put up a fight to provide the air defense that we need.

So I guess that tells us something about the attitude of this subcommittee. Anyway, we would be happy to hear your testimony. Thank you.

**STATEMENT OF MAJ. GEN. DONALD R. INFANTE, COMMANDING GENERAL, U.S. ARMY AIR DEFENSE ARTILLERY CENTER AND COMMANDANT, U.S. ARMY AIR DEFENSE ARTILLERY SCHOOL, FORT BLISS, TX, ACCOMPANIED BY BRIG. GEN. JERRY C. HARRISON, DEPUTY DIRECTOR OF WEAPONS SYSTEMS, OFFICE OF THE DEPUTY CHIEF OF STAFF FOR RESEARCH, DEVELOPMENT AND ACQUISITION, DEPARTMENT OF THE ARMY, AND BRIG. GEN. WILLIAM J. FIORENTINO**

General Infante. It is my honor to be with you today. We have a prepared statement we would like to submit for the record. What has gone on since last year—we would like to cover where we have been since last year.

## OPENING STATEMENT OVERVIEW

### Statement Highlights

Threat, employment concept, weapons programs, division (forward area air defense) systems, corps systems, echelons above corps systems, summary.

This gives you sort of a road map of what has happened to us.

If you look at the division area, that is the forward area air defense area, I am sure you are all aware that the Secretary of Defense canceled the Sergeant York Program. The Army regrouped after that, and we conducted the forward area air defense [FAAD]

study in the September–December 1985 timeframe. Mr. Weinberger, on the 8th of January, approved the FARD study recommendations in principle.

Now, that is the news up in that part of the battlefield. When you move back to the rear, you look at the corps and you look at echelons above corps, it is a good-news story. If you look at the corps and talk about Hawk, all of our improvements there are on target, and we have Hawk. If you look at the Patriot, that is one of the Army's greatest success stories. So the news in that portion is a good-news story.

We are going to focus today mainly upon the forward area, but we do have some types of improvements.

## POWERFUL TRENDS ALL AIR FORCES WILL FOLLOW

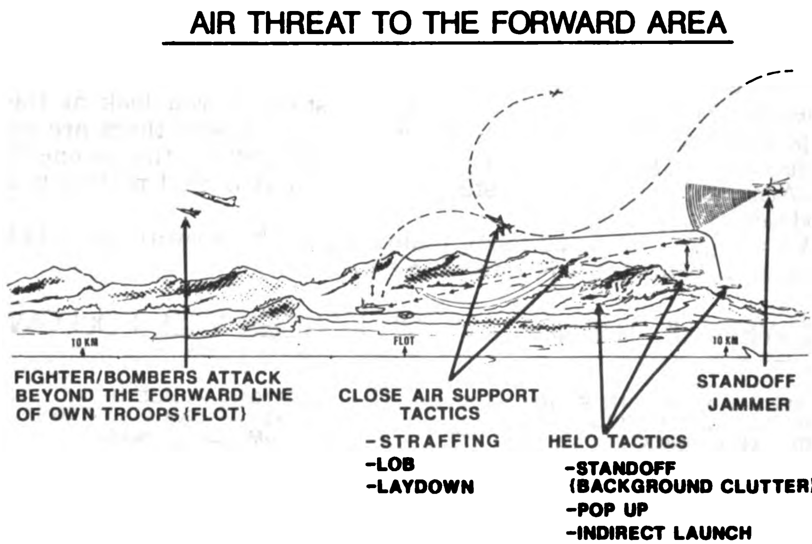
| | |
|---|---|
| ● STANDOFF MUNITIONS FROM LOW ALTITUDE HELICOPTERS AND FIXED WINGS | - BEYOND RANGE OF LINE-OF-SIGHT SYSTEMS<br>- FROM BEHIND MASK |
| ● SUPPRESSED PLUMES, AND INFRARED (IR) JAMMERS | - DEGRADE IR MISSILES |
| ● ANTI-RADIATION MISSILES | - ATTACK LOW DENSITY SURFACE TO AIR MISSILE (SAM) SYSTEM RADARS |
| ● LOW OBSERVABLE TECHNIQUES PLUS ELECTRONIC COUNTER-MEASURES | - REDUCE RANGE OF SAMS |
| ● UNMANNED AERIAL VEHICLES & DRONES | - RECONNAISSANCE<br>- DEPLETE SAMS |
| ● SURFACE-TO-SURFACE MISSILES | - ATTACK SAMS & TACTICAL MISSILE LAUNCH SITES |

In looking at the threat that we are up against, I would not like to show you numbers today, sir, but just to sort of talk to you about trends. Here are six powerful trends that we think all air forces will follow. It is important that we consider these trends so we don't fall into the same trap we did with Sergeant York. We had a system that had a certain capability, and the next thing we knew, we faced an advanced threat that would in fact counter the Sergeant York system.

We will present to you today an entire force package that does, in fact, counter each one of these threat trends, whether we are talking about the enemy's ability to suppress his infrared signature or whether we are talking about Stealth technology, which reduces the range of our own missile systems.

However, of particular interest to this committee are the standoff munitions that will be launched from threat attack helicopters beyond the range of our line-of-sight systems. That threat is found in the forward area. I would like to expand on that forward area threat, please.

**FORWARD AREA THREAT**

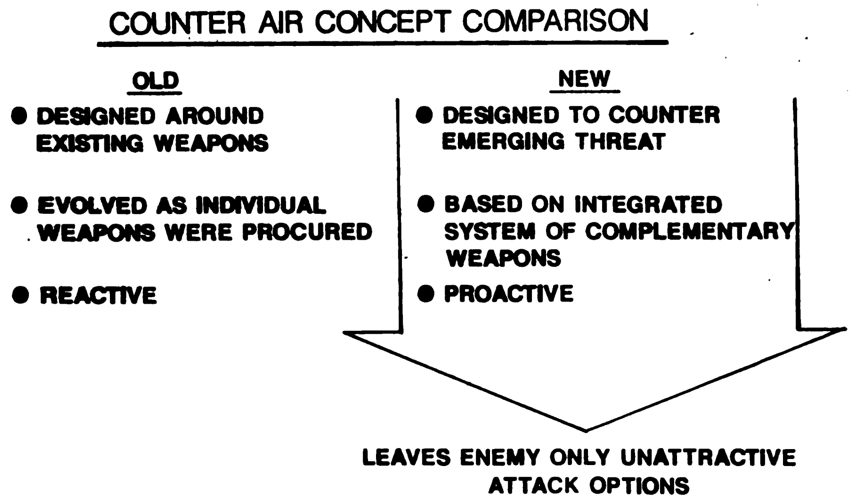


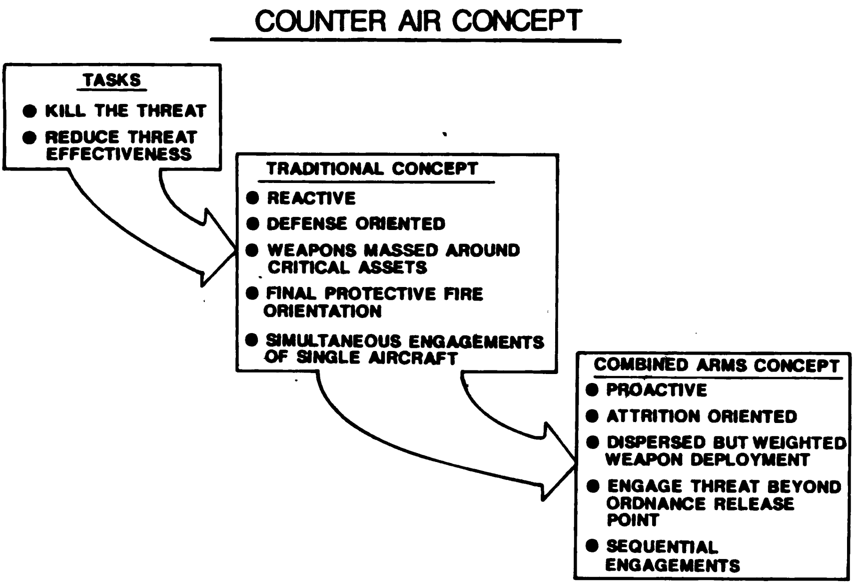

If we look to the air threat to the forward area, it is both a fixed wing, and it is a helicopter threat.

With regard to the threat helicopter, they have helicopters today that have antitank guided missiles with ranges up to about [deleted] kilometers. If we go to the timeframe 1995, we are talking about helicopters that pop up for very short exposure times. We are talking about helicopters that have the capability for indirect launch with regard to their weapons, and we are talking about antitank guided missiles with ranges up to [deleted] kilometers.

If we move back, you will see we also have a fixed-wing threat with regard to close air support. They are employing the same sort of tactics we do, both with regard to the fixed-wing threat forward and fixed-wing threat that could be transiting back to the rear and also attacking our forward division area with regard to our control centers and our sustaining centers.

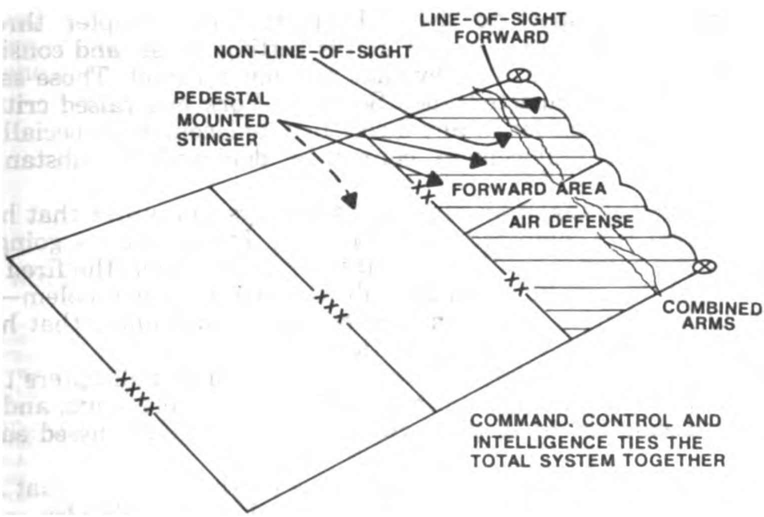
COUNTERING THE THREAT



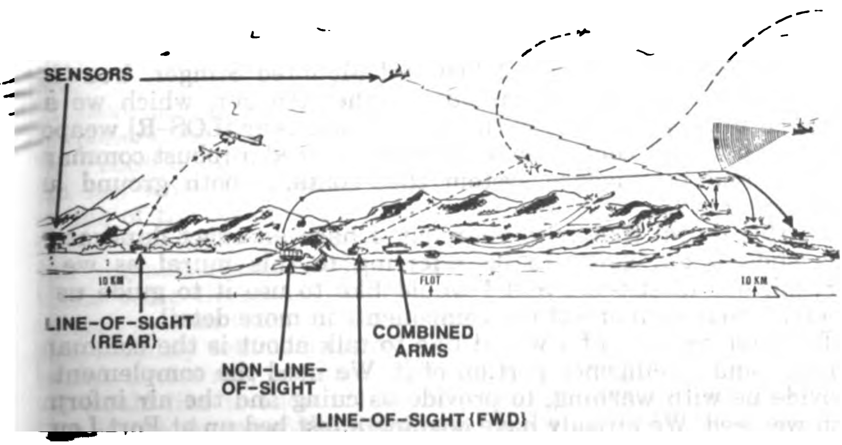

Next chart please. To counter this threat, we have come up with a counter air concept that is different from what you have heard in the past. We are still talking about the same task; that is, to kill the threat, whether it be in the air or on the ground. We are talking about reducing his effectiveness, both by passive and active measures.

## AIR DEFENSE OF THE BATTLEFIELD (DIVISION AREA)




Next chart please. I would like to break my discussion down with u, sir, from a systems point of view to implement that concept in e first area. The first area we are going to talk about is the for- ırd area air defense area, where we have our divisional forces lo- ted. That is where you heard of our weak and vulnerable area ıen you visited Europe. That area is where we do have the great- t need.

## FORWARD AREA AIR DEFENSE SYSTEM




COMMAND, CONTROL & INTELLIGENCE

Next chart please. Looking at our forward area defense system, and I should emphasize right up front that we are talking about a system consisting of components, that is similar to the Navy's aircraft carrier. The pieces work together, and they have a degree of complementary aspect to them. Look at the helicopter threat, which we already said is severe and is getting worse, and consider the tactics that are utilized by that helicopter threat. Those same helicopter tactics impacted upon Sergeant York and raised critical issues we must consider in any direct fire replacement, especially if that direct fire replacement cannot be deployed in substantial numbers.

The Army has taken an approach that says to counter that helicopter threat is a combined arms problems. That is, we are going to have the air defense artillery, the infantry, the armor, the fired artillery, and the aviation elements all focusing on that problem—all working together in a combined arms nature to counter that helicopter threat within their capabilities.

The air defense artillery, will also focus on those helicopters that are beyond the range of the other combined arms elements, and on that fixed-wing threat in the forward area that we discussed earlier.

A line-of-sight weapon, then, will focus on those targets that are out of range of the other combined arms elements. We also see a need for a non-line-of-sight element. This, I should add, is the only new air defense component in this year's budget. It was not identified in last year's discussion with you, sir.

FORWARD AREA AIR DEFENSE [FAAD] COMPONENTS

The non-line-of-sight [NLOS] component is an indirect fire weapon. We deploy this closely behind our maneuver forces, using terrain to mask it from the enemy view. It is launched vertically and flies out over the maneuver forces to attack the standoff or masked helicopter. It can also attack helicopters transiting up to the front. When it is not killing helicopters, it will kill tanks.

To handle the fixed-wing threat coming in to the division rear, we have a component called Pedestal Mounted Stinger. You [Mr. Stratton] saw one of the candidates, the Avenger, which we are going to talk about. This is the line-of-sight rear [LOS–R] weapon. To draw all these components together we need a robust command, control, and intelligence system that contains both ground and area sensors.

On this mural that is to your left, I have an exact duplicate of this slide. I am going to be referring to this mural as we go through our discussion, and I would like to use it to guide us in talking about each one of the components in more detail.

The first component I would like to talk about is the command, control, and intelligence portion of it. We need the complement to provide us with warning, to provide us cuing and the air information we need. We already have ongoing a test bed up at Fort Lewis. I would like to show a filmclip of a respresentative system.

This is a filmclip of our test bed at Fort Lewis. You will see first one of the ground sensor candidates. This is the Army's counter-

mortar radar, except we have turned it on its side, and we are now looking at using it in an air defense role.

You will next see the inside of the van, which is shown here is a mortar configuration. Here is the command control display containing some of the information we need. This is an example next of one of the hand-held processors that we could, in fact, give to anyone of the weapon systems.

COMMAND, CONTROL AND INTELLIGENCE SYSTEM

## FORWARD AREA AIR DEFENSE COMMAND, CONTROL AND INTELLIGENCE

FY 87
RDT&E REQUEST
$122.2M

- AWARD CONTRACT FOR $C^2$ SYSTEM DESIGN AND SOFTWARE DEVELOPMENT
- CONDUCT LIVE SENSOR SHOOT OFF EVALUATION
- CONTINUE PASSIVE ID DEMONSTRATIONS AND BEGIN FULL SCALE DEVELOPMENT
- COMPLETE AERIAL SENSOR CONCEPT DEFINITION

FY 87
PROC REQUEST
$0M

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 99.1 | 55.9 [1] | 122.2 | 141.9 | 298.2 | 717.3 |
| PROC | | | | 0 | 1785.4 | 1785.4 |
| QTY (SYS) [2] | | | | 0 | 18 | 18 |

1. $10.6M APPROPRIATED BUT NOT AUTHORIZED
2. DIVISION EQUIVALENT SETS

This is the Army's budget request for the command, control and intelligence system. We do have a plan to award a contract in 1987. We will select our ground sensor. We have placed greater emphasis upon passive technologies. We have gotten away from only active sensors and active identification. We have accelerated passive technology, and we would like a complete definition of our aerial sensors.

I next would like to talk about the line-of-sight rear [LOS–R] component. Here the primary candidate is the weapon we called the Pedestal Mounted Stinger. One example is the Avenger that you saw when you visited on the west coast recently. That would be one of the primary candidates. We are talking about a weapon we need to take care of the fixed-wing aircraft transiting to the rear and also attacking our command and control system.

The basic thrust of the weapon system is to take the Stinger weapon system that was on a soldier's shoulder and mount it on a high-mobility vehicle an give it eight Stingers with an improved detection device and improved identification devices.

I would like to show a filmclip of two of the leading candidates. One is the Avenger that you saw. We were doing some shoot-on-the-move testing again at Fort Lewis, and so both of these shots will be for shoot-on-the-move, showing two of the primary candidates.

As you directed last year, we will have a full shootoff in the last quarter of this year. This will be the first shot. They are shooting at a ballistical aerial target that is pretty hard to see, but it did knock it down.

The next shot is a shot of the Setter. Again, it is going to be an on-the-move shot. Both missiles were fired by soldiers from the 9th Infantry Division at Fort Lewis.

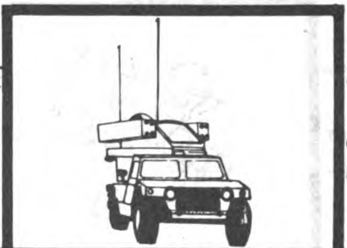
Here is a picture of the soldier and a picture of the shot going down range. You will see that we had a direct hit.

STINGER/PEDESTAL MOUNTED STINGER

STINGER/PEDESTAL MOUNTED STINGER

FY 87
RDT&E REQUEST
$6.3M

- COMPLETE REPROGRAMMABLE MICROPROCESSOR (RMP) DEVELOPMENT
- CONDUCT PMS FOLLOW-ON TESTING



FY 87
PROC REQUEST
$293.0M

- PROCURES 4180 STINGER RMP MISSILES AND GROUND SUPPORT EQUIPMENT
- LRIP CONTRACT FOR PMS
- PROVIDES ADVANCED PROCUREMENT FOR MULTI-YEAR STINGER MISSILE CONTRACT($40.3M)

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E [1] | 242.5 | 23.3 | 6.3 | 0 | 0 | 272.1 |
| PROC [2] | 923.5 | 246.6 | 293.0 | 386.4 | 1945.0 | 3794.5 |
| QTY (SYS) | 11650 | 3439 | 4180 | 5964 | 25431 | 50664 |

1. INCLUDES FUNDS FOR PMS
2. INCLUDES SPARES AND MULTI-YEAR PROCUREMENT FOR MISSILES AND FUNDS FOR PMS

Now, here is the Army's budget request for fiscal year 1987, and it does as Congress directed. We will pick a winner by February of next year for Pedestal Mounted Stinger and get on with that program. We will continue procurement of Stinger. This year's buy will put us at about the 40-percent level. Fiscal year 1987 is the first year of a 5-year, multiyear contract that will save us $162 million total.

I would like, sir, to talk to you about the non-line-of-sight component. The non-line-of-sight component is required to go behind terrain features where helicopters are standing off or hiding and kill the helicopter or the tank in that area. This system will kill helicopters that could stand off and fire long-range ordnance while remaining out of range of the direct fire weapons of the combined arms. The leading candidate is a fiber optic guided missile [FOG-M], which was developed in-house by the Army's Missile Command.

I would like to show a February test shot of that particular system. As you will see, this is a vertically launched missile. We are going to evaluate another alternative, but the FOG-M is the leading candidate. You see the missile coming out of the tube vertically launched. You will now see it fly down range, and this is the missile, itself, flying down range.

In a second, you will see the drone target helicopter. The missile will come in on the side. We are now going to replay the engage-

ment and show you the recorded missile seeker view, what the missile and gunner saw. This is being flown by a soldier from Fort Bliss, TX, with about 2 weeks' training. He will lock up on the target in just a second. This was his first shot. He was a little bit nervous, as you might expect, but he finally got it on target, and you will see the missile hit the transmission of the chopper as it was flying away at a speed of about 60 knots.

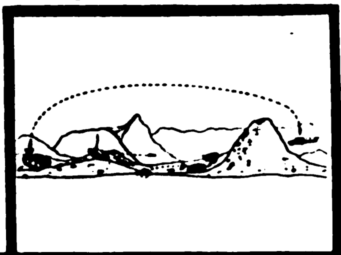
This was a nonwarhead shot. They were able to recover the helicopter, and we will use it again. That engagement would tend to ruin a pilot's day, as you might expect.

UNCLASSIFIED

FORWARD AREA AIR DEFENSE
NON-LINE-OF-SIGHT

FY 87
RDT&E REQUEST
$83.3M

- EVALUATE ALTERNATIVES
- CONTINUE FOG-M DEVELOPMENT
- TEST FOG-M IN OPERATIONAL ENVIRONMENT



FY 87
PROC REQUEST
$0M

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 0 | 19.7 [1] | 83.3 | 172.4 | 241.2 | 516.6 |
| PROC | 0 | 0 | 0 | 14 2 | 260.4 [2] | 274.6 |

1. APPROPRIATED BUT NOT AUTHORIZED
2. DOES NOT PROCURE THE TOTAL REQUIREMENT

UNCLASSIFIED

This is our budget request for fiscal year 1987. We are going to buy hard tooled prototype fire units for an operational test. We are going to test them at Fort Lewis with soldiers in a realistic environment. We will confirm the design by testing early and shooting early.

## FAAD NON-LINE-OF-SIGHT

The next component I would like to talk about is the line-of-sight forward piece, and that is the piece where we would have had Sergeant York had we decided to deploy it. So we are talking about the air defense component that we will be worried about primarily attacking, that helicopter out of range of the other combined arms elements. We haven't decided yet whether it will be a missile system only or missile and gun hybrid.

We released a request for information to industry on the 24th of January. Our intention in the last half of this year is to have demonstrations and validate contractor information. There are a number of candidates that we could select from.

## FAAD SYSTEMS CANDIDATES

I would like to show some of these candidates at this time. The first three will be missile systems only, and the fourth will be a

missile and gun hybrid. This first candidate is the tracked version of Rapier. The shot you will see is from a wheeled version of Rapier. They are shooting at a fixed-wing aircraft. It did have a direct hit.

The next candidate shown will be one on which the prime contractor is a U.S. firm. This is the Air Defense Anti-Tank System [ADATS]. This is a shot that took place at White Sands Missile Range about 18 months ago. You will see the shot from two aspects. First you see the missile leaving, and the next shot you will see will be from the aspect of the aircraft. You will be able to see the missile actually flying into the aircraft. We had a camera on board the aircraft. And that was a direct hit also.

The next system you see is one that is called the ARMAD. It has a RBS-70 missile that will pop up here in a second. This is one of the finalists in the Canadian competition. As you know, the Canadians are also buying their low level air defense system at this time. That target is a stationary helicopter.

The last candidate shown is a gun and missile system. It is a Stinger missile fired from a system called the Blazer. You will see a moving helicopter, and the Stinger missile launched against the helicopter. In the next shot, we will show you the gun component of that same system also going against a helicopter.

FAAD ALTERNATIVES

FORWARD AREA AIR DEFENSE
LINE-OF-SIGHT FORWARD (LIGHT)
(FORMERLY LADS)

FY 87
RDT&E REQUEST
$21.7M

- BEGIN P3I PROGRAM FOR PMS
  - GREATER GUN RANGE
  - ABILITY TO ACCEPT COMPLEMENTARY MISSILE
  - SENSOR IMPROVEMENTS

FY 87
PROC REQUEST
$0M

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 0 | 0 | 21.7 | 38.0 | 0 | 59.7 |
| PROC | 0 | 0 | 0 | 74.7 | 271.0 | 345.7 |

Here is the budget request that we have for 1987. As you can see, we are going to move on with an alternative system evaluation, and our plan is to have source selection and pick a winner in fiscal year 1987.

Now, I don't want to minimize the combined arms contribution to forward area air defense. Although I will not show a separate chart on that, I should mention to you we are making improvements in the combined arms elements to increase their capability

to go against helicopters. We are talking about improved tank ammunition, and improvements to our gun and fire control systems.

To wrap up, then, sir, the forward area defense, is a mural of that coverage. We think we have a robust system that will give us a credible and effective forward air defense force.

I would like now to transition, if you would, please, to the other parts of the battlefield and talk to you about the corps area next, where we have the Chaparral system.

Mr. Stratton. Let me ask a question here. You have got the forward area air defense positioned at the 10-kilometer range there. My impression is that the forward areas don't extend that long. You have got a few pieces here and pieces there. You are not going to have an opportunity, it would seem to me, to utilize some of these long-range things you are talking about.

General Infante. Sir, we need to use longer range air defense weapons. If we can, in fact, strike deep and kill helicopters [deleted] before they have a chance to come forward and add to the enemy's combat power, disrupted his plan. He is now reacting to us, and we can stop his ability to implement his plan.

So our hope is that we can go deep, and that is why we want to allow him only undesirable attack options, which is what this family of systems called the forward area air defense does.

The only entirely new system, sir, that we have this year that we didn't have last year is the non-line-of-sight system. Otherwise, every single component we had was in last year's budget.

We have taken a different approach to improve our ability with regard to combined arms against helicopters. We have taken the command information piece and placed additional emphasis on passive sensors and the need for an aerial sensor, and we have integrated it all better and given ourselves a better capability. But we hope to go deep and use all these systems.

Mr. Stratton. You are focusing on the forward area, the divisional areas. In the divisional areas you are going to get battalion headquarters, you are going to get the smaller units, the forward observers. They are not going to be spread out over this kind of terrain. They are going to be pretty closely grouped.

General Infante. I think they will be spread out, sir. If you look at the battlefield from this particular aspect, going from 10 kilometers on his side, let's say, 10 kilometers on our side, and that is just a representation, of course, of the mural.

With regard to forward area air defense, we are talking about going back to our division rear boundary, which is approximately 20 kilometers to the rear on our side. We are going to have them sort of spread out, like that. This system, for example, visualizes it to be about 5 kilometers to the rear. This would probably be about one-half kilometer to about 1 kilometer behind our tanks, which would be forward.

We do hope to have them spread out that way across the battlefield to allow deployment to their fullest potential.

Mr. Stratton. That isn't the way that I have seen them laid out. Certainly in World War II, the area of a division was relatively small.

General Infante. Yes, sir.

DIVISION FRONTS

If you look at some of our division fronts today, for example in Europe, division fronts run somewhere up to, as much as 40 kilometers across the front for some of the fronts we have in XII Corps. So the frontages are a lot bigger than we had in World War II.

We do have a bigger area that we have to fight in, but, of course, the key to us is to have combat power in the right place at the right time. We think if we do have that flexibility, that this range of weapons allows the enemy only unpreferred attack options.

If you go back to the trend slide we had, we are countering every single one of those trends.

Mr. STRATTON. You are talking about fronts in Europe. The thing Europe doesn't have is a lot of space. So I don't know what you are talking about when you are talking about your fronts in Europe.

General INFANTE. Well, if we look at the front of this division, for example, a typical division would probably have somewhere between a 20- to 30- to, in some cases, 40-kilometer front along that way. And if you go to the rear, you are talking about 20 to 30 kilometers rearward also. Those are the sort of frontages we have within Europe today. If you look at the number of tanks that you could expect to have forward on any one of those divisions, you find about [deleted] tanks spread across the front as a representative number.

What we are saying is that we are going to take these area defense systems, for example, a representative number might be [deleted] for that line of sight forward, and we are going to array them at the right place on the battlefield to bring that combat power to bear. This might be [deleted] for the non-line-of-sight systems. When you take numbers like that and you begin to put them in those sort of dimensions along with [deleted] tanks, we do have a lot of room, and the key to us is to be able to put them in the right place at the right time, which is why we think it is so important to have a robust command and control information network.

So, room, sir, from our perspective, shouldn't be a problem.

Mr. STRATTON. You are talking about exercise areas, is that right?

General INFANTE. No, sir, I am not. I just returned from 5 years in Europe, and I am talking about actual European frontages.

Mr. STRATTON. Yes, but you are not going to—you are not setting them aside for your training. If you are going to be in a defensive position, you are going to have to operate in areas where there are structures, where there are homes.

General INFANTE. Yes, sir. And so will the enemy. The enemy only has certain avenues of attack, you and I both know, he is going to be able to come on. The key for us becomes to be able to deploy our forces to be in the right place at the right time. Even considering that, we think we have enough room.

Mr. STRATTON. OK. Go ahead.

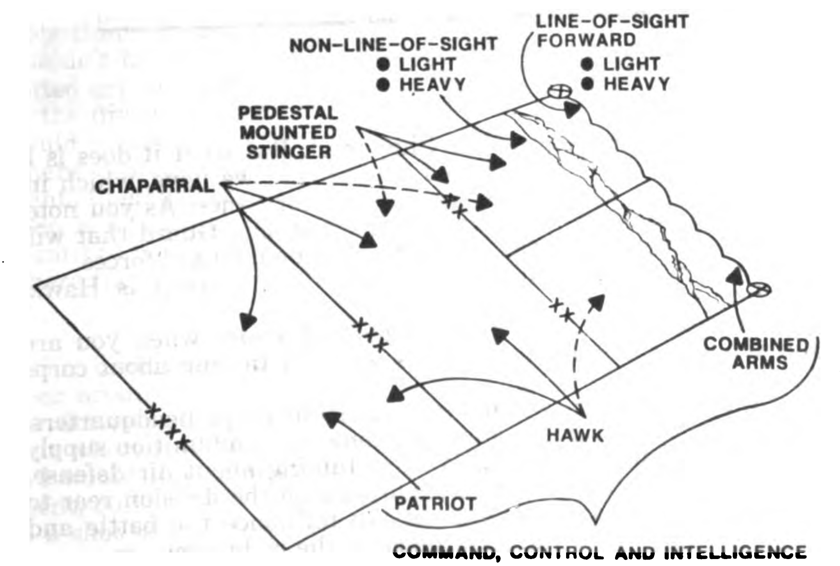
General INFANTE. Yes, sir. Thank you.

**CHAPARRAL**

## STATEMENT HIGHLIGHTS

- THREAT
- EMPLOYMENT CONCEPT
- WEAPONS PROGRAMS
  - ► DIVISION (FORWARD AREA AIR DEFENSE) SYSTEMS
  - ► CORPS SYSTEMS
  - ► ECHELONS ABOVE CORPS SYSTEMS
- SUMMARY

## AIR DEFENSE OF THE BATTLEFIELD



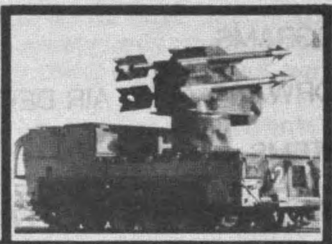

Moving back to the corps, Chaparral is the first system. First deployed in 1969, it is in both the Active Force and National Guard. We fielded our first National Guard battalion in 1986 with deployment of the second battalion to be completed in 1987. Our thrust this year is to improve the Seeker by giving it an improved infrared countermeasure capability and to give us a greater range.

This is a shot of the Chaparral. As you can see, this is a proven system. The plans are to continue deployment in the National Guard so we will have two battalions by the end of 1987 and other battalions going in, in 1988 and 1989. We have had eight shots of the Rosette Scan Seeker, and five have been successful. We do have some additional shots planned for this summer.

CHAPARRAL

FY 87
RDT&E REQUEST
$5.6M

- COMPLETE DEVELOPMENT OF ROSETTE SCAN SEEKER (RSS) MISSILES
- CONDUCT FLIGHT TESTS AGAINST ADVANCED INFRARED COUNTERMEASURE TARGET



FY 87
PROC REQUEST
$111.6M

- PROCURES RSS MISSILE
- PROCURES FLIR NIGHT SIGHTS AND MINIMAL SMOKE ROCKET MOTORS
- WEAPON SYSTEM MODS

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 228.8 | 17.5 | 5.6 | 0 | 37.1 | 289.0 |
| PROC [1] | 545.1 | 169.2 [2] | 105.6 | 118.3 | 1250.4 | 2188.6 |
| MODS | 371.9 | 129.7 | 6.0 | 14.6 | 263.2 | 785.4 |
| QTY (MSL/FU) | 13320/544 | 0/40 [3] | 456/0 | 960/0 | 10474/0 | 25210/584 |

1. INCLUDES SPARES
2. $111.0M APPROPRIATED BUT NOT AUTHORIZED TO BE REPROGRAMMED FROM WTCV (FOLLOW-ON GUN)
3. NOT SHOWN ARE 24 FU'S FUNDED UNDER ARNG PROCUREMENT APPROPRIATION

Here is the budget request for Chaparral. But what it does is it allows us to procure this improved Seeker that we have, which increases acquisition and countermeasure performance. As you note, we have some buys for fire units for the National Guard that will complete the program for Chaparral for National Guard forces.

The next system I would like to talk to you about is Hawk. Hawk, of course——

Mr. STRATTON. Wait. Let me ask again, because when you are talking about air defense for a corps, are you talking about corps headquarters?

General INFANTE. Sir, we are talking about corps headquarters, we are talking about corps-sustaining elements, ammunition supply points, logistical supply points. We are talking about air defense, such as Chaparral, that could be deployed into the division rear to give the corps commander the ability to influence the battle and put his combat power in the right place at the right time.

Mr. STRATTON. You have got a corps there; that corps is in command of the two divisions forward of it.

General INFANTE. Yes, sir. In this schematic, that is correct.

Mr. STRATTON. And probably the area behind it. So there is no way that you could have a unit machine that can spread over the entire corps area. It has got to be a headquarters that you are trying to protect.

General INFANTE. Well, you have to look at the range of these weapons, sir. For example, Chaparral, with the improved range, will have a range of about [deleted] kilometers. So that is really a shorter range air defense weapon.

If you are talking about Hawk, a representative range might be [deleted] kilometers. When you talk about a corps front—for example, if you take 5th Corps, the average front of 5th Corps is about [deleted] kilometers. If you take 7th Corps in Europe, you are talking about frontages in excess of [deleted] kilometers.

So you take a weapon with a range of 8 kilometers, you want to put it around some sort of critical asset that is of great value to you, if you are talking about an 8-kilometer weapon. If you are talking about a 25-kilometer weapon, you can use that in more of an area defense role, where you provide some air defense to everybody. And then you have to remember that you are talking in many cases about fixed-wing aircraft transiting at very low altitudes, which because, as we all know, the Earth is not flat, your radar coverage is limited.

Mr. STRATTON. Yes; but you are not—this is a corps area, you have got an army out there as well. These are all going to be attacked in all directions in the battlefield.

General INFANTE. Amen.

Mr. STRATTON. The idea that one weapon is only for corps and another weapon is for a division I think is sort of a nonsequitur.

General INFANTE. Well, we think you are right. OK?

Now, we are talking about the command headquarters that controls that element of combat power. That is not to say that we wouldn't have Chaparral deployed in the division as you see by the dotted arrow. That is not to say you wouldn't have Hawk deployed in the division. That is to say that that element of combat power would be under the corps commanding general for him to decide where it would be best utilized to support the combat power he wants to emphasize within that corps.

So it gives the corps commanding general some flexibility with regard to how to utilize his particular resources. That is not to say where they would be fought necessarily.

HAWK

Sir, back to Hawk, if I may proceed. Hawk, as you know, has been around for a long time. It is the free world's most proliferated air defense system. It gained its credibility in 1973 in the Israeli war where it killed more than 20 Mig and other aircraft.

I would like to show a test shot of our latest product improvement, our phase 3 improvement, where we launched [deleted]. This is a shot of the Hawk system and some of its communications antennas. This is a shot of its acquisition radar.

[Deleted.] That would also tend to ruin a pilot's day.

**HAWK MODIFICATIONS**

## HAWK MODIFICATIONS

**FY 87**
**RDT&E REQUEST**
**$10.6M**

- CONTINUE DEVELOPMENT OF FIELD MAINTENANCE EQUIPMENT (FME) PIP
- COMPLETE FUZE ARM DEVELOPMENT

**FY 87**
**PROC REQUEST**
**$83.2M**

- BEGIN FUZE ARM PRODUCTION
- CONTINUE PHASE III MOD KITS/INITIAL SPARES PRODUCTION
- PROCURE 39 REPLACEMENT ROCKET MOTORS

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 324.1 | 5.1 | 10.6 | 15.9 | 149.7 | 505.4 |
| MODS [1] | 447.3 | 74.7 | 83.2 | 77.0 | 417.9 | 1100.1 |

1. INCLUDES ROCKET MOTOR REPLACEMENT REFLECTED IN OTHER MISSILE SUPPORT

Here is the budget request that we have, sir, for 1987. You can see the main thrust is to continue that authorization to give us the simultaneous capability you saw here.

## STATEMENT HIGHLIGHTS

- THREAT
- EMPLOYMENT CONCEPT
- WEAPONS PROGRAMS
  - DIVISION (FORWARD AREA AIR DEFENSE) SYSTEMS
  - CORPS SYSTEMS
  - ECHELONS ABOVE CORPS SYSTEMS
- SUMMARY

Now, the last part of the battlefield I would like to talk with you about, sir, talks about echelons above corps where we have Patriot, truly one of the Army's success stories.

We have two battalions in Europe now, we have a third battalion undergoing training at Fort Bliss. It will be deployed to Europe in the fall of this year. We will activate two more battalions this year. The system is coming off the production line about on time with reliability twice that of the specifications, so we are very, very pleased with this system.

Here is a test shot we conducted last year, where we had three Patriot missiles in the air simultaneously against three Drone air-

craft. This first shot you will see will be a nonwarhead shot, the second two shots will be with warheads. This is the Patriot phased array radar, a shot of the communications antennas and some of the soldiers in placing the sytem. A maintenance-free round, completely sealed cannister, that is the first shot.

You will see a second missile in just a second from the same launcher, and you will see a third missile from a separate launcher being fired against three incoming aircrafts, all three at low altitudes. That was a nonwarhead shot, a direct hit. The last two are warhead shots.

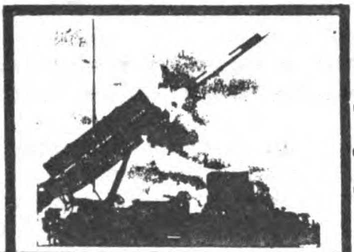
In this instance, all three intercepts were within [deleted] meters. So we had a three-for-three there.

**PATRIOT**

**PATRIOT**

FY 87
RDT&E REQUEST
$40.2M

- ECCM ENHANCEMENTS
- RAM UPGRADE
- DIRECT JTIDS INTERFACE



FY 87
PROC REQUEST
$1074.8M

- PROCURES 12 FIRE UNITS AND 700 MISSILES
- FIRST YEAR OF FIVE YEAR MULTI-YEAR CONTRACT
- ADVANCED PROCUREMENT TO SUPPORT MULTI-YEAR CONTRACT

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E [1] | 2088.8 | 50.8 | 40.2 | 50.2 | 200.4 | 2430.4 |
| PROC [2] | 4566.3 | 1020.6 | 1033.9 [3] | 1038.6 [3] | 2202.3 [3] | 9861.7 |
| MODS [2] | 13.7 | 18.7 | 40.9 | 64.1 | 253.3 | 390.7 |
| QTY (MSL/FU) | 1590/55 | 585/12 | 700/12 | 715/12 | 2447/9 | 6037/100 |

1. REFLECTS CONVERSION FROM BASIC SYSTEM TO MODS RDT&E
2. INCLUDES SPARES
3. INCLUDES ADVANCED PROCUREMENT TO SUPPORT MULTI-YEAR CONTRACT

This is the budget request that we have for fiscal year 1987. As you can see, we are continuing our procurement of our fire units and our missiles. This is the first year of a 5-year multiyear contract that will save the Government $315 million. This will be the eighth production year of Patriot, and it is a stable system, and we are very, very pleased with it.

## PATRIOT INTERNATIONAL PROGRAMS

- ▶ NETHERLANDS - BUY 4 FIRE UNITS AND 160 MISSILES
- ▶ JAPAN - LICENSED PRODUCTION FOR 26 PATRIOT FIRE UNITS
- ▶ BELGIUM, ITALY AND KOREA HAVE EXPRESSED INTEREST
- ▶ FEDERAL REPUBLIC OF GERMANY - COOPERATIVE AGREEMENT

●● FRG BUYS 14 PATRIOT FIRE UNITS

| | | |
|---|---|---|
| ●● US PROVIDES 14 PATRIOT FIRE UNITS WHICH BECOME FRG PROPERTY AFTER 10 YEARS | $ = $ | FRG PROCURES, MANS AND INTEGRATES 27 ROLAND FIRE UNITS INTO US AIR BASE DEFENSE SYSTEM FOR 10 YEARS<br>FRG MANS, OPERATES AND MAINTAINS 12 US PATRIOT FIRE UNITS FOR 10 YEARS |

●● FRG BUYS 60 ADDITIONAL ROLAND FIRE UNITS TO PROTECT FRG AIR BASES

●● PROVISIONS FOR TERMINATION AND FOLLOW-ON AGREEMENTS

Sir, I would like to summarize for you—woops, I am sorry, one more thing. The international slide, please.

Mr. STRATTON. Saving money by going down with the——

General INFANTE. I have spent 2 years in Korea. I don't see the analogy, sir.

Mr. STRATTON. You said you were going to save money by saving all this money you want us to spend. This is a tough year this year.

General INFANTE. Every year, as you are well aware, is a very, very tough year for us.

Mr. STRATTON. This is the first one to have Gramm-Rudman on its tail.

PATRIOT MULTIYEAR COMPARISON

## PATRIOT MULTIYEAR COMPARISON

($ THEN YEAR)

| COST | FY87 | FY88 | FY89 | FY90 | FY91 | TOTAL |
|---|---|---|---|---|---|---|
| ANNUAL BUY | 1058.6 | 1027.3 | 974.5 | 640.0 | 601.7 | 4302.1 |
| MULTIYEAR | 996.8 | 952.8 | 912.1 | 572.5 | 553.1 | 3987.3 |
| SAVINGS | 61.8 | 74.5 | 62.4 | 67.5 | 48.6 | 314.8 |
| SCHEDULE (U.S. ONLY) | | | | | | |
| FIRE UNITS | 12 | 12 | 9 | - | - | 33 |
| MISSILES | 700 | 715 | 815 | 817 | 815 | 3862 |

General INFANTE. Yes, sir. That is true. But the fact remains we, the Government, can save money by introducing stability into our programs, and one way to save money and introduce stability is to have multiyears, and in the case of the Patriot system, $315 million, it would seem to us, sir, is something worth going after.

Mr. STRATTON. Do you want to put that slide up there?

General INFANTE. Yes, sir. Back up one please, Mike.

Maybe I could quell some of your apprehensions, sir, by saying while we have had negotiations with the contractor, and if there are Gramm-Rudman cuts, we have and will negotiate options that take those cuts into consideration and will still result in savings. While it won't be as much, because we are buying fewer quantities per year and it would stretch out the buy a little bit more, it would still allow us the flexibility to respond to Gramm-Rudman and would still save us money.

Mr. STRATTON. This is just one system. You have got $1 billion in that one system. What about the rest of them now? How much are they going to cost?

General INFANTE. Sir, the total procurement for this year is $1.7 billion.

Mr. STRATTON. That is for the Patriot.

General INFANTE. No, sir. For the Patriot what we are asking for procurement is about $1.1 billion.

Mr. STRATTON. I mean you have got all those other things, you have got your Stinger, your Chaparral——

General INFANTE. Yes, sir.

Mr. STRATTON. What is the total?

General INFANTE. OK, sir. For fiscal year 1987, procurement dollars are about $1.7 billion.

Mr. STRATTON. $1.7 billion.

General INFANTE. Yes, sir. Procurement funds.

Ms. SLATKIN. Do you have a chart that lays out all the programs and dollars for 1987 that are in those programs? That might be easier.

General INFANTE. No, I am sorry, I don't have such a chart.

[The following information was received for the record:]

**OVERVIEW AD BUDGET CHART FOR RECORD**

The following chart is an overview of the FY 1987 Air Defense RDTE and Procurement Programs:

[In millions of dollars]

| | | Amount |
|---|---|---|
| RDTE: | | |
| 63313 | Fiber optics guidance | 5.0 |
| 63302 | ATM (w/o submunitions) | 28.6 |
| 63323 | LADS | 21.7 |
| 63757 | Non-line-of-sight AD sys | 83.3 |
| 63757 | Non-line of sight AD sys | 83.3 |
| 64306 | Stinger | 6.3 |
| | Classified program | 6.7 |
| 23730 | Chaparral | 5.6 |
| 23731 | Hawk | 10.6 |
| 23746 | Patriot | 40.2 |
| 63315 | AD targets | 9.7 |
| 23739 | AN/TSQ-73 Mods | 9.7 |
| 63706 | IFF | 20.4 |
| 64709 | IFF | 9.9 |
| 63740 | Shorad $C^2$ aerial sensor | 16.2 |

| | |
|---|---|
| 64741 Division AD $C^2$ | 82.1 |
| Total AD RDTE | 376.6 |
| Procurement (includes initial spares): | |
| Chaparral | 105.6 |
| Air defense—heavy | 9.1 |
| Other missile support | 6.5 |
| Patriot | 1,033.9 |
| Stinger/PMS | 293.0 |
| Patriot Mods | 40.9 |
| Chaparral Mods | 6.0 |
| Hawk Mods | 76.7 |
| Air defense targets | 32.4 |
| Total AD procurement | 1,604.1 |

This may be of some help to you. It lays out the Patriot multiyear. Of course, Patriot will be our big expenditure over the next couple of years. What we do, sir, is compare the annual buy versus multiyear and the savings year by year.

Mrs. HOLT. There is the comparison.

General INFANTE. If we looked at that on a year-by-year basis for that particular system, I think we can see multiyears in this particular case is to our advantage.

Mr. STRATTON. Any questions on that?

Mr. Ray.

Mr. RAY. General, I think it looks like you are making a bit of progress in air defense here. Does this fit into the overall DOD plan that Secretary Weinberger sent over to us in 1985, I believe it was, the air defense—coordinated air defense plan for NATO, in particular?

General INFANTE. Yes, sir, it does. If I may go to my next chart, as a matter of fact, it talks about the international aspects of Patriot, and is probably one of the best answers to your question that I could really give, and that has to do with the fact that we look at it from a NATO perspective. The Netherlands have already signed a contract for buying four fire units and 160 missiles and received their first Patriot unit this month, sir. The Germans will receive their first fire unit in fiscal year 1987.

FAAD CONTINUED MODIFICATIONS

And, of course, we have improved our NATO air base defense with sort of a complicated arrangement where they will buy 14 Patriot fire units, but we will provide 14 Patriot fire units to them in exchange for them providing Roland fire units for our defense. There are 12 Patriot fire units they man but are U.S. owned for a period of 10 years. So we definitely do see substantial progress with regard to improving our NATO air defense.

And, in addition, we have the Belgians, the Italians, who have shown interest to us, and if you go around to the other side of the world, we have the Japanese, who have already signed up to produce in their country, of course, [deleted] Patriot fire units, and we have the Koreans, who expressed interest in it.

Mr. RAY. Our best interests would be in central NATO with the equipment you have in place and on line to be in place.

General INFANTE. Yes, sir, that is correct. The 5th Corps and 7th Corps, which is where these are. When the Germans get their system, sir, as you know, then we begin to expand, from the United States sector in the middle out to the German corps that back our corps, and also up to the north, if you are talking about the 1st German Corps.

Mr. RAY. Is our overall plan, if you will bear with me a little bit, an idea we are going to beef up central NATO pretty heavy at first and move into the southern flank on NATO and continue that modification in there?

General INFANTE. Yes, sir, that is the plan. However, I should tell you we have only had initial discussions with the Italians, and they have not at this time made a firm commitment to improve their air defenses, but they have showed a high degree of interest.

Mr. RAY. What about Greece and Turkey? Are you familiar with Turkey's arrangement we have over there?

General INFANTE. Yes, sir.

Mr. RAY. Rapier, is that right?

General INFANTE. Yes, sir. There is a U.S. Air Force program to put Rapier in Turkey.

Mr. RAY. So we have a very weak situation in this other flank?

FAAD DEPLOYMENT

General INFANTE. With regard to air defense, we do, yes, sir. But, of course, if you take where we think we are going to have the majority of the threat deployed versus where we had the majority of our air defenses deployed, we have the strongest air defense where we have the largest threat.

Mr. RAY. But that is likely to detour down to the northern and southern flankings, I suppose.

Could you just explain a little bit, then, about how we are going to have these positions, the Patriot, the Hawk, the Chaparral, the Stingers in place? I guess you would be considering air defense in the central area of NATO.

General INFANTE. Yes, sir.

Mike, would you put up any one of those charts? The top lays out the battlefield for us. The area we have been talking about, of course, sir, we started up our discussion up here in the forward area, and that the discussion where we were talking about our overall ability to defend our maneuver forces to insure we have the freedom to maneuver to allow us to put our Reserve forces in the right place at the right time and to protect our command and control centers and sustaining assets and assure our forward line of troops has that freedom that is so important to us.

To assure we can do that particular part of the battlefield, the Army has the forward area defense system we talked about in some detail with you on. If we move back to the rear, then we are talking in this particular area, for example, about air base defense, and that is where you would ordinarily find that type of defense. And that particular part of our defense is strong now and is getting stronger every day.

If you confine yourselves at this time to the U.S. segment, when we move outside the U.S. sector, we have plans for improvements,

but it is not on the ground yet. When you get beyond that sector and get into the portion of Italy and down in that particular part of the world, it is sort of in the planning stage at this time.

Mr. RAY. If we are successful in funding this by this year, what are we going to need in 1988, 1989, and 1990? What percentage of completion stages will we be in?

General INFANTE. Sir, with regard to improving our ability in this part of the battlefield and making our defense strong in that, the majority of our funds are to buy 12 more units this year which will go to Europe. That will give us an increased capability in the near future, because those systems are coming off the production line at a regular rate, and they are really performing well for us.

Now, if you move up to the forward part of the battle area, there we have in this year's budget a research and orientation toward our funds, and it is going to take longer for us. We are probably talking about the 1989 timeframe before we can get this Stinger portion of the system out. The first improvement will be in 1989.

If your move forward on the non-line-of-sight component, you are probably talking about the 1990 timeframe. If you move forward on the line-of-sight forward component you are probably talking about the 1989 timeframe.

### FIELDING PATRIOT

General HARRISON. Sir, with regard to the Patriot, buy what you see for this year, when that is fielded, about 49 percent of our systems will be in the field, so we will be about halfway there with what we are going to buy this year.

Mr. RAY. None are staying here for training purposes?

General INFANTE. Not so, sir. We are going to fill the battalion at Fort Bliss sometime in the near future, and that will be our first battalion. One of those battalions, in fact, will stay in the States.

Mr. RAY. You think that is wise, when the threat is overseas right now?

General INFANTE. Yes, sir, I do. We have to maintain personnel for efficiency.

Mr. RAY. We don't plan to put a whole lot of them in the United States?

General INFANTE. No, sir, not at all. We have a total, as a matter of fact, of three Patriot battalions——

Mr. RAY. Mr. Chairman, could I have another minute?

Mr. STRATTON. Yes.

Mr. RAY. What initiatives are being planned to counter the Soviet counterballistic threat? Do you have this in consideration?

General INFANTE. Yes, sir, we do. I can talk to you in some depth about the defensive aspect of that. And if you look at the Patriot missile system, we have an ongoing program right now to counter the [deleted] threat through some software changes that will give us capability there in the [deleted] timeframe.

### PATRIOT IMPROVEMENTS

Mr. RAY. That is on the Patriot?

General INFANTE. Yes. [Deleted.]

Mr. RAY. We are moving firmly ahead in that?

General INFANTE. We are. Those are coming along fine.

Mr. RAY. Mr. Chairman, that is all I have right now, but I might like to come back later.

Mrs. HOLT. Mr. Chairman, I move the chairman be authorized to go into executive session for 5 additional days of hearings for the purpose of receiving classified information affecting the national security.

Mr. STRATTON. The clerk will call the roll.

Ms. SLATKIN. Mr. Stratton.

Mr. STRATTON. Aye

Ms. SLATKIN. Mrs. Byron.

[No response.]

Ms. SLATKIN. Mr. Mavroules.

[No response.]

Ms. SLATKIN. Mr. Skelton.

[No response.]

Ms. SLATKIN. Mr. Leath.

[No response.]

Ms. SLATKIN. Mr. Dyson.

[No response.]

Ms. SLATKIN. Mrs. Lloyd.

[No response.]

Ms. SLATKIN. Mr. Ray.

Mr. RAY. Aye.

Ms. SLATKIN. Mr. Spratt.

[No response.]

Ms. SLATKIN. Mr. Bustamante.

[No response.]

Ms. SLATKIN. Mrs. Holt.

Mrs. HOLT. Aye.

Ms. SLATKIN. Mr. Badham.

[No response.]

Ms. SLATKIN. Mr. Courter.

Mr. COURTER. Aye.

Ms. SLATKIN. Mr. Kramer.

[No response.]

Ms. SLATKIN. Mr. Davis.

[No response.]

Ms. SLATKIN. Mr. Hopkins.

[No response.]

Ms. SLATKIN. Mr. Hunter.

[No response.]

Ms. SLATKIN. Mr. Chairman, we have four "ayes."

Mr. STRATTON. I don't know how long we will be able to keep it open, because I think the business of the House is already——

Mrs. HOLT. We might have another vote.

Mr. STRATTON. Let me ask a few hard questions here. What is the overall cost of the forward area air defense system that replaces the Sergeant York gun?

General INFANTE. That is a very difficult question, and I can't and shouldn't give you a firm answer at this time, because we really don't have a specific configuration, for example, on the line-of-sight forward component, which is going to be one of our big drivers, I can tell you this, in general terms—Mr. Hopkins?

Mr. HOPKINS. I move I be recorded as "aye."
Mr. STRATTON. Without objection, so recorded.
We have to know what the cost is, and we have got to know when these systems will enter the service. When will that be?
General INFANTE. We will begin to improve our forward force in the 1988–89 timeframe with a system such as the one you saw. That will be the first improvement to our forward force.
Mr. STRATTON. We are going to have to continue to go without the forward air defense until 1989?
General INFANTE. We will be able to in 1988 or 1989 have that Avenger-type system that you saw into the field. That will be the first piece that will go in. In 1989, we hope to have that line-of-sight forward piece which was the list of four candidates that I showed you. This, the non-line-of-sight, you are looking at 1989 to 1990. That was the fiber optic guided missile that went behind the hill that I showed you.
So the answer to your question, it would be the 1989–90 timeframe before we have substantial improvement.
Mr. STRATTON. Until the Secretary of Defense eliminated the DIVAD, we had protection for our troops in Germany and in Europe. We have removed that now, and what you are telling me is that you have got a lot of sophisticated stuff, but none of it is going to be available to protect the troops on the ground until [deleted].
General INFANTE. Sir, we do have on the ground right now coming off the production line Stinger, which, as you know, is vastly improved over the Redeye system. We are making product improvements to our Vulcan system to improve its accuracy. We are and have discussed with you today the Chaparral Rosette Scann Seeker, which will give us improvements. We have a product improvement to our Hawk system, and Patriot is working absolutely superbly. So I would say to you we are making improvements to our air defense systems and improving our air defense capabilities.
Mr. STRATTON. You are not improving the forward air defense capability, which is what the DIVAD was supposed to do.
General INFANTE. Not as quickly as we probably should or would like to see. But we have a plan that will give us a forward area air defense system.
Mr. STRATTON. If I was out there myself, I think I would be a little worried whether I was going to be able to stick it out until [deleted]. Has this been approved by the Secretary of Defense?
General INFANTE. Yes, sir. It was approved by him on the 8th of January.
Mr. STRATTON. And it has been approved by the Army?
General INFANTE. Yes, sir.
Mr. STRATTON. When is it going to be tested?
General INFANTE. We will begin testing on pedestal mounted Stinger, for example, the Avenger type, we are going to begin that the last quarter of this fiscal year.
Mr. STRATTON. Mr. Hunter has asked to be recorded voting "aye" on the motion to go into executive session.
Mr. HUNTER. Yes, I have.
Mr. BADHAM. I will ask unanimous consent to have my name recorded.

Mr. STRATTON. Without objection, the gentleman will be so recorded.

FAAD COST

What is the overall cost of the forward area air defense system that replaces the Sergeant York gun?

General INFANTE. The total cost of this system, sir, is not well known at this time, because, for example, we really haven't selected a specific system to replace the Sergeant York at this time.

Mr. STRATTON. Well, from what I could see, you had a slim Avenger, and then you had a tank Avenger. Those, I assume, are— Nora.

Ms. SLATKIN. Do you have a range of costs you can provide the subcommittee at this time?

Mr. NECESSARY. Or are you looking backward——

General INFANTE. I would be more than happy to provide a range of estimates for the committee. I would hope that range would be acceptable. I can say to you in gross terms, it is our feeling we will have a much more effective air defense with the forward area defense system than if we had proceeded with the Sergeant York program, and we don't expect it to cost much more.

[The following information was received for the record:]

DIVAD REPLACEMENT RANGE OF COSTS

It is important to understand that the Forward Area Air Defense (FAAD) program is a system of five major subsystems. Only the Non-Line of Sight (NLOS) is a new requirement. The other subsystems (Command, Control and Intelligence (C³I); Line of Sight-Rear (LOS(R)); Line of Sight Forward (LOS(F))-Heavy and Light Divisions; and Combined Arms Initiatives) are not new and were already in the Army budget. The FAAD program has integrated these subsystems together to optimize the contribution of each in meeting the growing air threat facing our divisional forces. The FAAD program will cost between 8-22 billion dollars. Only a cost range can be provided at this time because final selection of two FAAD subsystems, NLOS and LOS(F)-Heavy Division, has not been made yet. The FAAD program is fully funded in FY87. The out year budget requirement is based on the low estimate of 8 billion dollars. There are several FAAD subsystems under funded in the out years (i.e., NLOS and Air-to-Air Stinger for the UH-60, AH-64 and AH-1). The shortfall is approximately 750 million dollars and is being addressed in the Army's POM 88-92 cycle.

Mr. BADHAM. Lots of luck.

Mr. STRATTON. It is not too precise.

General INFANTE. You are absolutely right. But that is the best answer I can give you at this time.

Mr. BADHAM. Secretary Latham was before our subcommittee this morning. I just happened to be there, and I just happen to be here now. I can assure you it is by accident in both cases. But after he gave his description of this forward area air defense, which is basically some kind of an integrated weapon system that is both gun and missile and that satisfies both the outgoing parties in the Pentagon. I assume that is going to have an effective range perhaps over the first hump of about [deleted] kilometers, which is what is presumed to be sometime in the future the projected ability of the Soviet close air support helicopter that can sit behind the brow of a hill and lop some kind of guided weapon systems over a hill from about [deleted] kilometers.

General INFANTE. You didn't need to come to my briefing.

Mr. BADHAM. As long as I am here, sir—so General Ike made the comment to Secretary Latham, "It sounds good, it sounds effective, it sounds expensive, and a long way off. What are our poor Army troops going to do in the interim?"

The answer is pretty much nothing. We don't even know how much this is going to cost. And that is for 2½ kilometers additional.

General INFANTE. Sir, if I may just add to what you said. You are right if you are talking about we have turned the front to go against fixed-wing and against helicopters at [deleted] kilometers range. But what you didn't say—what Mr. Latham did not say is that we have a non-line-of-sight component that will go back as deep as possible [deleted] kilometers to get the helicopters before they get up to that particular point. So that is a new addition. When it is not killing helicopters, it can also kill tanks. He did not mention that piece, and that particular piece is the new wrinkle that this committee did not see last year. They did see the line-of-sight forward, perhaps, under some different names last year. That piece last year was Sergeant York.

Mr. BADHAM. I didn't say everything he did say, so don't say he didn't say something if I didn't say he specifically did say it. But beyond that, I don't blame your shop—you know, the Sergeant York is gone, and I don't blame your shop for doing what you are doing now, which has kind of the same acronym as the Catholic Youth Association.

But you have to do that because when you kill one system you desperately need, the next system has to be more inclusive. I can understand that. I am not digging your system, but I am going to have fun with the people who advocated a faster—a quicker end to development, cheaper, more effective DIVAD. I am going to have fun with those people when they bring this up on the floor.

Mrs. BYRON. May I ask unanimous consent to be recorded as voting "aye".

Mr. STRATTON. Without objection, you will be so recorded.

General, what manpower restraints were placed on your air defense plan, and what fiscal constraints were placed?

### AIR DEFENSE MANPOWER CONSTRAINTS

General INFANTE. With regard to the manpower constraints, as you know, we have a plan called the "army of excellence," and each one of the combat branches is assigned so many personnel to implement that plan. This entire plan I have talked to you about today meets previous manpower constraints.

So from a personnel point of view, from a fiscally constrainted point of view, we really started off asking ourselves what is it we need to do the job in a credible fashion? A lot of what I have talked to you today about was in last year's budget. Given we are where we are at that particular point, we asked ourselves, what could we do best about that Avenger-type system that we have? And so we already had a lot of the systems that we had to proceed with that we do have some cost on.

The only totally new system that we are talking about, of course, is this non-line-of-sight component. We are looking for candidates

for the line-of-sight forward which is one reason I can't give you a specific cost. It will be required to do more than the Sergeant York was required to do in many areas. We are looking at candidates for that piece. Until we can pin those candidates down specifically, it is going to be difficult for me to give you anything but a range of cost, which I will provide.

Mrs. BYRON. I have a couple questions.

Mr. STRATTON. Mrs. Byron.

Mrs. BYRON. Let me start you on a counter concept. What kind of role will the helicopter play in that? If so, will they use existing munitions? Are we going to have to look at different types of munitions? Are we going to be talking about placing offensive missiles on helicopters to attack air defense of the enemy, or is that a possibility?

COUNTERING THE HELICOPTER THREAT

General INFANTE. Let me take them one at a time. You touched upon improvements we are making to our combined Armed Forces to counter the helicopter threat, of which one aspect of this is improvement to our aviation forces. With regard to the aviation force improvements, we are accelerating an air-to-air Stinger program, and we do have funds in the budget to accelerate that program.

Mrs. BYRON. How much?

General HARRISON. We are going to come in to try to accelerate this fiscal year and bring it forward at least 1 year.

Mrs. BYRON. Bring it forward a year?

General HARRISON. Yes, ma'am.

General INFANTE. We are going to mount those primarily on our scouts, and they will be used in both a self-defense role and be used in an air-defense reinforcing role, where we can move them around the battlefield to fill in air defense gaps, if we have to.

Mrs. BYRON. With the acceleration of 1 year, does not this committee have a part to play in that since it is unauthorized?

General HARRISON. Yes. We will come over and ask for it, Yes, ma'am. We have not done that yet, but that is part of this whole plan to bring those packages in and accelerate air-to-air Stinger.

Mrs. BYRON. The Army proposes to incorporate the Stinger missile in a variety of helicopters. Does this fit into the forward area defense system concepts?

General INFANTE. Yes, ma'am, it does. The air-to-air Stinger will be a viable part of our combined arms force, and it will also have the capability to be moved around the battlefield in a gap-filling role.

Mrs. BYRON. Is it correct that they are reprogramming? Do you have a basic idea what the initial procurement is going to be on reprogramming?

General HARRISON. The initial procurement is in the 1987 request, $28.8 million, and that is in the aircraft budget.

Mrs. BYRON. The necessity to speed up and to upgrade that program, I think, is agreed on by almost everyone. I think the question that we are going to be asking is about the source of funds, which you touched on. I think everybody on this committee is

going to be looking hard at reprogramming when they come over, so I would suggest you better have line item by line item ready.

General INFANTE. Yes, ma'am.

Mrs. BYRON. I have no further questions.

Mrs. HOLT. Mr. Chairman, may I?

Mr. STRATTON. Yes.

Mrs. HOLT. I want to get back to Sergeant York for a minute. What are you going to do with the assets that we have as a result of that, the radar and the other things? Isn't there a plan to——

### SERGEANT YORK ASSETS

General INFANTE. Yes, there is a plan. For example, in the last quarter of this year, we are looking at candidates for our ground-based sensors. One of those candidates will be the Westinghouse radar, which was, of course the Sergeant York radar. That particular candidate and other candidates will have a fair and equal chance to compete, and we will select the winner from the list of those candidates.

Mrs. HOLT. But didn't we buy some originally that at one time we were talking about using in some other system? Is that right?

General INFANTE. Yes, ma'am. We do own some radars. The Government owns some of those radars. If the Westinghouse radar wins, we could utilize them.

Mrs. HOLT. Otherwise, there will be no use for them, they are down the drain?

General INFANTE. There are no firm plans.

Mrs. HOLT. At one time there was, wasn't there? I was told we were going to be able to use them, all that wasn't going to waste, that we could use those assets that we had gotten. But you have no plans for it now?

General FIORENTINO. Ma'am, if I may talk to that, please. We do have a team that is looking at the resources which are available, the hardware which the Government has already purchased and accepted. They have identified a series of claimants within the Army and then within the other services, and we will make a decision probably by the end of March as to how those assets should be distributed.

We are trying to see if people need large elements, we will give them that, and then go into smaller and smaller subsets. So we do have a team in place to try to make an efficient distribution of the assets.

Mrs. HOLT. End of March?

General FIORENTINO. Yes, ma'am.

Mrs. HOLT. Thank you.

Mr. STRATTON. Mr. Ray.

Mr. RAY. General, the modernization of the National Guard units appear to be linked to the fielding of the Sergeant York gun, and now that we don't have that, how has the modernization of the National Guard been affected?

### NATIONAL GUARD MODERNIZATION

General INFANTE. Yes, sir. As I mentioned previously, we already have deployed Chaparral to the National Guard, one battalion in

fiscal year 1986, and we will complete to fill in the second battalion in fiscal year 1987. We have a plan to complete through 1991 additional Chaparral units. The largest impact—I should add at the same time Hawk is going to the National Guard with the first Hawk unit going to the National Guard, I want to say fiscal year 1987. The real impact on National Guard modernization will be that the Vulcan systems we had planned to withdraw from the Active Force and give to the guard will now have to be delayed until we can come up with the line-of-sight forward component.

I should add to compensate for that, what we plan to do is, when we deploy the Stinger for the system the chairman saw on his visit, our distribution plan is to field those systems to the National Guard at the same time they are going to the Active Forces. So that will help to offset the delay of the Vulcan, which was the primary impact, sir.

Mr. RAY. A couple more questions. In this area of budget cuts in Gramm-Rudman that we are facing, do you feel that you are going to be able to provide stable funding, going to be able to get stable funding to enter into a multiyear contract for the Patriot missile?

General INFANTE. Yes, sir, we do.

Mr. RAY. You have examined the mechanism of Gramm-Rudman?

General INFANTE. I can assure you, everybody in the Army has examined the mechanisms of Gramm-Rudman in excruciating detail. I spoke with the prime contractor, myself, this morning at a senior vice-presidential level to insure the information I gave this committee was factual and accurate, and he assured me that we would be able to negotiate options that if Gramm-Rudman cuts were imposed, we would take those cuts and be able to adjust the contract.

Mr. RAY. Do you believe there will be some proposed savings in this arrangement?

General INFANTE. Yes, sir, there will be proposed savings even in an era of Gramm-Rudman cuts, if you compare it to the single year-by-year contract that we have.

Mr. RAY. I see. What impact do changes to the U.S. Patriot program have on the POM? Do they have any?

General INFANTE. It has the benefit, of course, of increased quantity, and that has had some impact upon our price, but not a lot, honestly. The real benefit is that, of course, now we have a strong air defense across the entire NATO front or at least that central European part, as opposed to having it focused into two U.S. ports.

Mr. RAY. Are you familiar with Mr. Don Frederickson, who has been appointed by DOD to help coordinate the air defense program?

General INFANTE. Yes, sir, I know him well. He is a fine gentleman.

Mr. RAY. You just returned from Korea. Are you satisfied with the air defense plan we have there in South Korea?

General INFANTE. I returned from Korea in 1975. I did recently return from Germany. I know what we have in Korea with regard to U.S. air defenses, and I can certainly talk to that if you would like.

Mr. RAY. Any weakness in radar, radar support, we might need?

General INFANTE. Korea, sir?

Mr. RAY. No, in your present plan, do you have all the radar coverage we need?

General INFANTE. Sir, we will, because we have gone from a ground sensor only to a lightweight aerial sensor only.

The second shift has been to go from active sensors to passive sensors. When you talk radars, sensors is perhaps a little bit more comprehensive term, and in this program, we put greater emphasis upon passive sensors. If we execute the program the way we have it planned, we have an adequate sensor coverage.

Mr. RAY. Would you comment on the aerial sensor? Is it the Aquila?

General INFANTE. No, sir, we are not getting into that one today. I know we had a lot of discussion on that particular topic. I just tell you at this time, we are looking at any one of three possible platforms. One could be a RPV of any type, and we are not tied to any one. It could be an aerial platform, either a helicopter or a fixed-wing aircraft. We have not decided upon the platform yet.

Mr. RAY. Unmanned or manned?

General INFANTE. Unmanned, sir.

Mr. STRATTON. Mr. Spratt asked permission to be recorded as voting "aye" on going into executive session?

Mr. SPRATT. I do, indeed.

Mr. STRATTON. The gentleman will be so recorded.

Ms. SLATKIN. We have nine members voting "aye."

Mr. STRATTON. The authority, therefore, is granted to go into executive session in the coming week.

If there are no further questions, the committee will stand adjourned until—

Mr. HUNTER. Could I ask one question before we adjourn?

Mr. STRATTON. Yes.

Mr. HUNTER. I apologize for not being here for earlier remarks. ATBM missile, that is a place where you folks could really make a mark on the SDI program and actually handle a lot of peace efforts. Maybe more importantly, if you could develop a package that would assure our European allies—the French, for example, are very concerned about building a system although they bad-mouth SDI in general—is anybody stirred up over there about the possibility of building a Western model, something that could defeat SS-20's of SS-21's?

General INFANTE. Sir, I discussed earlier that the Patriot system has ongoing improvements at this time to give us the capability in the near term against the [deleted]. And those programs are funded and are underway at this time.

General HARRISON. Let me add to that, you hit it right on the head when you say we can do a lot at the low end, and we are, and we are also tying in the Strategic Defense Command and the SDI people and antitactic ballistic missiles, where all of us are meeting together to sort out that whole threat.

We have a lot of work to do, but we recognize exactly what you say.

Mr. HUNTER. We may want to work with the French and Germans, too. The Germans are moving ahead right now. But we have to know what we have.

In talking with Army people, nobody is exactly sure what we have. At least, I haven't met them yet. I know you folks are going to come over and talk about it. If we could sum up our inventory of technology in a general way, I would appreciate it.

General HARRISON. We will come over and tell you about it.

Mr. HUNTER. I think Mr. Perle and Mr. Weinberger would be interested in that, too.

Thank you, Mr. Chairman. I appreciate it. It is always good to come in the last 5 minutes and keep the whole committee here.

Mr. STRATTON. Thank you very much, Mr. Hunter.

The subcommittee, then, will stand adjourned until 1 o'clock on Monday, and the staff, General, will probably have some questions that they would like answered for the record, if you will.

Thank you very much.

Mrs. HOLT. Thank you, gentlemen.

[The following questions were submitted by Mr. Stratton to be answered for the record:]

## COMMAND AND CONTROL

Mr. Stratton. What is the acquisition plan for the Command and Control System.

General Infante. For acquisition purposes, the Forward Area Air Defense Command and Control (FAAD $C^2$) System consists of two major elements: the command and control element and the sensor element. Acquisition will be under separate contracts with the $C^2$ element contractor responsible for integrating the sensor into the system. The FAAD $C^2$ System acquisition strategy capitalizes on the use of non-developmental item (NDI) hardware such as computers, displays, sensors, and peripheral equipment to provide a $C^2$ system that fulfills user requirements. The acquisition approach for both elements uses NDI hardware components. NDI equipment will include items meeting specified FAAD $C^2$ system requirements and may range from military items already in the DOD inventory to militarized commercial items that have completed or will complete development in time to support program milestones. For the $C^2$ element, we plan to begin Full Scale Development this year. This effort is executed through a System Integration Contractor who develops the detailed system design, develops the required FAAD $C^2$ software, and performs system integration. For the ground sensor element, we plan a non developmental sensor candidate "shoot-off" in FY87 followed by a contract award in FY88. Both the $C^2$ and sensor elements will be tested as an integrated system in FY89. We plan to begin procuring common Army Command and Control System (ACCS) hardware in FY88 to integrate with the FAAD $C^2$ software and sensors. This system will be tested in FY90 prior to a Full Scale production decision and IOC.

Mr. Stratton. And, what is your estimate of total program cost?

General Infante. The cost of the FAAD $C^2$ component of the FAAD Command, Control and Intelligence element of FAAD is $1.16 Billion.

Mr. Stratton. Provide a schedule for the planned research and development phase and planned procurement phase for the Command and Control system.

General Infante. Program schedule for the Forward Area Air Defense Command and Control (FAAD $C^2$) system is as follows:

4QFY86 Award Contract for Full Scale Development for $C^2$ architecture.

1QFY87 Release RFP for non-development sensor.

4QFY87 Sensor shoot-off and source selection.

2QFY88 Begin sensor production prove out. Conduct sensor operational test and evaluation.

2QFY88 Begin limited Production of $C^2$ sets to support integrated operational tests and training. These sets consist primarily of common Army non-developmental hardware items from the Army Command and Control System and other programs.

3QFY89 $C^2$/sensor integrated system initial operational test and evaluation.

4QFY89 First Unit Equipped.

3QFY90 System Integrated DT/OT on production hardware.

4QFY90 Full Scale Production Decision

4QFY90 IOC

Mr. Stratton. How much concurrency is included in this schedule?

General Infante. We have some concurrency in this schedule. We plan to begin procurement of a few command and control (C2) hardware sets in FY 88 prior to the planned integrated system Initial Operational Test and Evaluation (IOTE), to support an FY90 DT/OT with production hardware and school trained soldiers and to support initial fieldings.We feel the risk is low as the hardware, primarily non-developmental computers, displays, and peripherals, is planned to be common Army items to be used by multiple Army systems. These could be redirected to other programs if the C2 IOTE shows further system maturity is required. The sensor will enter a limited production phase in FY 88 to support the FY89 IOTE and FY90 DT/OT. An evaluation of the candidate sensors to include independent development and operational tests will precede this phase. An OT will be conducted on the first sensor articles delivered in FY88 prior to an increased rate sensor production decision.

Mr. Stratton. What is current operational test schedule for the command and control system?

General Infante. We plan to conduct operational tests as follows:

FY87 Non-developmental ground sensor candidate evaluations to support source selection.

FY88 Non-developmental ground sensor Operational Test (OT) to support sensor production decisions.

FY89 Integrated $C^2$ architecture/ground sensor Initial Operational Test and Evaluation (IOTE)

FY90 Integrated $C^2$ architecture/ground sensor OT to support full scale production decisions.

Mr. Stratton. How much testing will occur prior to obligation of procurement funds?

General Infante. First, our acquisition strategy emphasizes use of already developed hardware. The U. S. Army Operational Test and Evaluation Agency, in addition to the development testers, will be involved with systems development from the start using Continuous Comprehensive Evaluation to monitor and evaluate contractor and government tests at the contractor's plant prior to any field tests. The sensor candidates will be thoroughly tested prior to source selection and a production contract award. To preclude unncessary delay in fielding FAAD C2, we will procure a limited number of $C^2$ hardware sets prior to system initial operational test and evaluation (IOTE). We believe the risk is low due to the fact that the hardware is planned to be common items of Army equipment such as computers, displays, and peripheral equipment that can be prioritized to other users should IOTE reveal that additional system maturation is required prior to continued low rate production. In addition, the

continuous comprehensive evaluation should provide information based on early efforts. This limited production will support the planned DT/OT in FY90 with production hardware and school trained soldiers in preparation for Milestone IIIb decisions and initial fielding.

PEDESTAL MOUNTED STINGER

Mr. Stratton. Why is the Army reorganizing its total STINGER force by replacing 60 STINGER teams with 36 pedestal mounted versions in each division?

General Infante. The Forward Area Air Defense Working Group recommended that 36 Line-of-Sight (Rear) systems were the minimum number needed to protect those critical assets located in the heavy division's rear area against air attack. The Pedestal Mounted STINGER (PMS) system is our Line-of-Sight (Rear) system. It overcomes the man/machine interface problems that could reduce the effectiveness of our STINGER manportable teams. PMS also allows us to make fuller use of the STINGER missiles capabilities and provides us with a day/night and adverse weather capability. Additionally, a manportable STINGER team can have, at best, only two ready to fire missiles; whereas a PMS team has eight ready to fire missiles. This results in greatly increased firepower. Therefore, although the number of STINGER fire units in the heavy divisions has been reduced from 60 to 36, those 36 fire units will be greatly enhanced in terms of efficiency and effectiveness.

Mr. Stratton. By reorganizing all of the STINGER teams; will you lose the ability to disperse the teams in a tactical situation? Will you lose the ability to deceive the enemy? Have you done any cost-effectiveness analyses that guided this decision?

General Infante. Our STINGER teams will not lose that ability to tactically disperse when they convert to Pedestal Mounted STINGER (PMS). PMS will be mounted on a HMMWV, the same vehicle the manportable (MANPAD) STINGER team would have had and we will require that each PMS team will retain the ability to fight in the MANPAD mode if the tactical situation does not allow the use of the PMS. This ability to employ our STINGER missiles in either the PMS or the MANPAD configuration will allows us to achieve the desired degree of tactical deception.

Although we have not yet completed our cost-effectiveness analysis on the entire Forward Area Air Defense (FAAD) system, the field test conducted in the 9th Infantry Division (Motorized) and the analysis done in support of the FAAD Working Group Study both support the immediate fielding of PMS.

STINGER

Mr. Stratton. Is second sourcing an attractive option for the STINGER missile? Why not? The Army plans to buy more than 56,000 missiles in the future?

General Infante. The Department of Defense Cost Analysis Improvement Group (CAIG) reviewed a study conducted for the Army on the feasibility of establishing a second production source for STINGER. The review agreed with the Army conclusion that it would be extremely difficult to establish a second producer and break even. Alternate cases which varied multiple parameters including the addition of over 21000 missiles to the program were investigated. The CAIG review and the Army study are in the final

stages of staffing and should be forwarded to Congress shortly. The Army is currently reworking the total requirement for STINGER missiles because of the Forward Area Air Defense Study Group report. The Army requirements are expected to be less than 56,000 STINGER missiles in the future.

Non-Line of Sight (NLOS) Air Defense System

Mr. Stratton. Why is the Army only now embracing the concept of Fiber Optic Guided Missiles?

General Harrison. The Army has been developing the FOG-M since it reached the concept development stage in 1981. This capitalized on years of development of fiber optics by private industry. The system has undergone evolutionary growth and it has been considered for a wide range of applications to include anti-armor, intelligence, and recently, air defense. When the Army conducted its study of the forward area of the battlefield in the wake of the SGT YORK termination, it examined any weapon that could have an application in defeating hovering helicopters standing off from our maneuvering forces and using terrain to be hidden from view. The FOG-M was found to be the most promising weapon screened for that non line of sight mission. Ten FOG-M test flights had been conducted prior to the study team briefing the Secretary of Defense its findings in January 1986. The Army has been very interested in FOG-M through its development and is now enthusiastic about its prospects in taking an air defense mission.

Mr. Stratton. How does this missile work?

General Harrison. Once the soldier in the FOG-M vehicle is alerted to a target, he need only give the system a target azimuth or coordinates to proceed with missile firing. The system automatically fires the missile vertically to a designated altitude, brings its nose down, and flies in the commanded direction. The FOG-M is a precision guided anti-helicopter missile that utilizes an imaging seeker for target acquisition, transmits the image from the missile to the soldier in the FOG-M vehicle through a fiber optic datalink, and receives steering commands back through the line to control the missile to target impact. The soldier performs the target recognition function and "locks on" the automatic tracker in the gunners station to the missile seeker image.

Mr. Stratton. What is the acquisition strategy for the Fiber Optic Guided-Missile?

General Harrison. The formal staffing of the Acquisition Strategy for the Non-Line of Sight (NLOS) Air Defense system, of which FOG-M is the most promising candidate, was initiated once the Army briefed its study findings to the Secretary of Defense, and has not yet been approved. However, if FOG-M is the concept followed for NLOS, the Army is in an excellent position to develop a very competitive arena for its production. Since FOG-M has been developed "in-house", the Army can request that industry compete to build a system for which the majority of the design work will have been completed. However, the Army will only decide to proceed with production when adequate developmental and operational testing is completed.

Mr. Stratton. Provide your schedule for operational and developmental testing of the Fiber Optic Guided Missile.

General Harrison. The FOG-M has been undergoing developmental testing for several years. Following Concept Development in 1981, unguided aero-propulsion flights began in May, 1983. The first

guided flight in April 1984 covered five kilometers. The first test of the missile against a helicopter was in November 1985 when a nine kilometer shot scored a direct hit on a Cobra helicopter positioned on the ground. In February 1986 the FOG-M scored a direct hit on a flying drone UH-1 helicopter which was traveling at approximately 60 knots at 75 feet in altitude. That's a quick review of where we have been. From here our FOG-M test program should be as follows:

FY 1986 Fire multiple missiles. Fire from High Mobility Multipurpose Wheeled Vehicle (HMMWV). Fire with Infrared Seeker and continue development.

FY 1987 Complete Cost and Operational Effectiveness Analysis (COEA). Conduct User Test at Fort Lewis, Washington. Conduct Pre-Planned Product Improvement ($P^3I$) testing.

FY 1988 Complete User Operational Testing. Continue $P^3I$ testing.

FY 1989-FY 1990 Continue $P^3I$ testing.

FY 1991 Independent Operational Test and Evaluation (IOTE).

We also know that we will conduct Product Verification Tests to ensure that production systems meet contract specifications. The Test and Evaluation Master Plan (TEMP) is currently in draft form and should be completed this summer. If we should decide that an AMRAAM NLOS System is the best way to accomplish the mission we would have a different test schedule entirely.

Mr. Stratton. What are the alternatives to this missile and what are the comparative costs?

General Harrison. The Army is evaluating whether a surface launched version of the Advanced Medium Range Air-to-Air Missile (AMRAAM) is a better method of satisfying the mission of NLOS. This evaluation will be conducted this year. Early estimates place the program cost of an AMRAAM ground launched system at approximately 12 billion dollars, or six times as expensive as a FOG-M program. This cost must be confirmed and will, of course, be a significant consideration. No other alternative is under review at this time but we are looking at whether any systems already in the combined arms or in development may have an interim capability to meet this mission.

## FORWARD LINE OF SIGHT, HEAVY DIVISION (FLOS-H)

Mr. Stratton. Fiscal Year 1987 is the first year of a $1.5 billion program for the line of sight system for heavy forces. What are the total requirements in terms of quantities?

General Infante. 516 line of sight - forward (heavy) (LOS-F(H)) fire units are required. The total is based on four fire units per battalion task force - the minimum required. This results in 36 per heavy division (11 each), 12 per armored cavalry regiment (3 each), 12 per separate brigade (3 each), with the balance being for spares and the engineering/training base.

Mr. Stratton. What constraints led you to these particular quantities?

General Infante. The overall Forward Area Air Defense System is constrained by the Army of Excellence manpower ceilings. The line of sight-forward (heavy) weapon, a component of this system, is, inturn, constrained by this same force structure.

## FORWARD AREA AIR DEFENSE

Mr. Stratton. In the DIVAD tests, what lessons did you learn about the likelihood of a single air defense weapon acquiring a hovering helicopter at long ranges?

General Infante. The SGT YORK (DIVAD) FY85 Follow-On Evaluation (FOE) revealed that the hovering helicopter is a formidable threat to our divisional forces. It can hover at very low altitudes; stand-off at extended ranges and fire its anti-tank missiles; and remask and move to another location when detected. The versatility of this threat made it virtually impossible for the SGT YORK System and other alternative systems tested in FOE to effectively counter it at long ranges. Several important lessons were learned from the test. First, an air defense gun system cannot kill this threat at extended ranges. What it can do is force the helicopter to stand-off at a greater range and remask more than it would like to, thus reducing the helicopter's effectiveness. However, since the helicopter is not killed by the gun, the helicopter will eventually attrite our forces. Second, there are only a few missile systems available today that can reach out to the line of sight ranges postulated for the growing air threat. Third, there is no forward area air defense system fielded today, U.S. or foreign made, that can counter the "over the hill/out of sight" helicopter. And fourth, helicopters can remask when detected by a radar directed system and search out new location(s) where it is not vulnerable to air defense systems but still be in range of ground targets.

Mr. Stratton. Are these experiences causing the Army to add airborne sensors to the air defense network?

General Infante. The airborne sensor is being added to the Forward Area Air Defense (FAAD) program for several reasons: (1) to provide low level coverage out to and beyond the forward line of troops (FLOT); (2) to detect the "over the hill/out of sight" helicopter; and (3) to provide earlier air defense warning for our divisional forces.

Mr. Stratton. Why, then, does the Army need to also purchase a radar on the DIVAD replacement?

General Infante. The use of the airborne sensor does not eliminate the need for an organic sensor on the SGT YORK replacement. The airborne sensor is a supplement to rather than a replacement for the organic sensor. The SGT YORK replacement has to be able to operate autonomously and will need an organic sensor(s) to do so. These sensors do not necessarily have to be radars. The Army is looking closely at the FAAD $C^2I$ sensor suite and will ensure that sensor requirements identified for the weapon systems are only those that are essential to accomplish the mission.

## CHAPARRAL

Mr. Stratton. I understand that the Army proposes to use $110 million that was appropriated for Fiscal Year 1986 but not authorized to buy 40 additional fire units. Why does this make sense?

General Infante. The 40 fire units requested in Fiscal Year 1986 are to complete the CHAPARRAL portion of the Army National Guard air defense modernization program. These additional fire units will be used to complete the fielding of the fifth and sixth CHAPARRAL battalion for the Army National Guard.

Mr. Stratton. What is the Army's total requirement for CHAPARRAL fire units?

General Infante. The total Army requirements for CHAPARRAL fire units, the procurement objective, is 608 fire units. The 608 fire units include 12 fire units which were provided to Israel from the Army's inventory in 1973.

Mr. Stratton. How many CHAPARRAL fire units have we purchased to date? What is the remaining quantity to be purchased?

General Infante. To date the Army has purchased 532 CHAPARRAL fire units, 76 fire units remained to be purchased to complete the Army's program.

STINGER

Mr. Stratton. One critical element in assessing a multi-year request is stability of funding. In light of Gramm-Rudman, how can you guarantee stable funding for the STINGER missile? Are there other ways besides multi-year contracts to gain cost savings

General Infante. Stable funding cannot be guaranteed. Various contracting techniques such as range quantities and multiple options will be negotiated up-front to provide the necessary flexibility. The STINGER program has implemented as many cost saving measures as practicable. Some examples are:

a. General Dynamics currently has in excess of 90% competitive quotes on materials.

b. A lower cost rocket motor resulted from competition.

c. An aggresive breakout program.

The STINGER project office has reached the point where additional savings are dependent on value engineering proposals.

FORWARD LINE OF SIGHT, HEAVY (FLOS-H) WEAPON

Mr. Stratton. What progress has been made on plans for an operational test of the XM-274 75 mm gun system in the Air Defense role? What is the current schedule for testing? Is the 75 mm gun being considered as a potential candidate for the Line-of-Sight Foward System that replaces the SGT YORK program?

General Infante. The Army requested industry to provide information on a weapon which would defeat the growing fixed wing and helicopter threat that SGT YORK could not defeat. The XM-274, 75 mm gun system was submitted as a candidate. The current Army schedule for testing non-development item candidates calls for a demonstration to be held in CY86, subject to availability of funds. Technology testing of the selected system would occur in FY89 with a battery sized initial operational test scheduled for early FY90. The XM 274, 75 mm gun proposal submitted by AAI Corporation is receiving equal consideration with all other submissions in response to the request for information released on 24 January 1986.

## Prepared Statement of Maj. Gen. Donald R. Infante

(U) MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

(U) I AM MAJOR GENERAL INFANTE, COMMANDING GENERAL, US ARMY AIR DEFENSE ARTILLERY CENTER AND FORT BLISS, TEXAS. I REPRESENT THE DEPARTMENT OF THE ARMY FOR THIS HEARING ON THE FY87 BUDGET FOR AIR DEFENSE PROGRAMS. I HAVE A PREPARED STATEMENT WHICH I WOULD LIKE TO PRESENT TO THE COMMITTEE.

(U) THIS STATEMENT WILL SUMMARIZE THE AIRLAND BATTLE COUNTER TO THE AIR THREAT TO OUR FORCES, AND OUTLINE WHAT REQUIREMENTS THESE THREAT CAPABILITIES DICTATE TO OUR AIR DEFENSE ARTILLERY AND OTHER COMBINED ARMS PROGRAMS. NEXT, IT WILL DESCRIBE HOW THE ARMY INTENDS TO IMPROVE ITS EXISTING SYSTEMS AND ACQUIRE NEW ONES TO COMBAT THIS THREAT. Chart 1 (See charts at end of statement)

### OVERVIEW

(U) SINCE LAST YEAR, SEVERAL CHANGES HAVE OCCURRED IN THE ARMY'S AIR DEFENSE PROGRAMS.

(U) ON THOSE PORTIONS OF THE BATTLEFIELD CONTROLLED BY CORPS AND ABOVE, AIR DEFENSE IS A TOTALLY GOOD NEWS STORY. PATRIOT IN EUROPE HAS PERFORMED FAR BEYOND EXPECTATIONS. TWO BATTALIONS ARE ON THE GROUND AND A THIRD IS ON THE WAY. DEMONSTRATED FIELD OPERATIONAL AVAILABILITY EXCEEDS REQUIRED OPERATIONAL AVAILABILITY BY MORE THAN FORTY PERCENT. PATRIOT SYSTEMS ARE ROLLING OFF THE PRODUCTION LINE WITH RELIABILITIES EXCEEDING TWICE THE SPECIFICATIONS. OUR ALLIES IN THE NETHERLANDS AND GERMANY WILL SOON RECEIVE THEIR FIRST SYSTEMS, AND OTHER EUROPEAN ALLIES HAVE SHOWN AN INCREASED INTEREST DUE TO PATRIOT'S SPECTACULAR SUCCESS. THE JAPANESE GOVERNMENT HAS ALLOCATED FUNDS TO BEGIN PRODUCTION OF THEIR OWN PATRIOT SYSTEMS UNDER AN AGREEMENT WITH THE UNITED STATES. HAWK, THE AIR DEFENSE MAINSTAY

OF THE FREE WORLD, WITH PROPOSED IMPROVEMENTS WILL CONTINUE TO MEET THE THREAT THROUGH THE 1990'S. WITH THE ADDITION OF A NEAR TERM ANTI-TACTICAL MISSILE CAPABILITY AND CONTINUED PRODUCT IMPROVEMENTS, OUR NEEDED COUNTER AIR CAPABILITIES WILL BE REALIZED IN THE CORPS AREA.

(U) IN THE FORWARD AREA OF THE BATTLEFIELD, THE ARMY HAS REGROUPED FOLLOWING THE AUGUST 1985 DECISION BY THE SECRETARY OF DEFENSE TO CANCEL THE SGT YORK PROGRAM. A FORWARD AREA AIR DEFENSE WORKING GROUP UNDER GENERAL OFFICER LEADERSHIP WAS ESTABLISHED BY THE ARMY TO DEVELOP A COMPREHENSIVE AND FULLY INTEGRATED COUNTER AIR APPROACH. OUT OF THESE EFFORTS, THE ARMY HAS FORMULATED THE FORWARD AREA AIR DEFENSE (FAAD) SYSTEM. THIS SYSTEM IS ANALOGOUS TO AN AIRCRAFT CARRIER IN THE NAVY, IN THAT THE PIECES FIT TOGETHER IN A COMPLEMENTARY FASHION TO PRODUCE A COMBAT CAPABILITY THAT EXCEEDS THE SUM OF THE INDIVIDUAL PIECES. THIS ALSO DICTATES, HOWEVER, THAT ALL THE PIECES MUST BE ADDRESSED TOGETHER AS A SYSTEM.

(U) FROM OUR RIGOROUS ANALYSIS OF THE FORWARD AREA AIR DEFENSE THREAT AND THE REQUIREMENTS NECESSARY TO COUNTER IT, SEVERAL SIGNIFICANT FACTORS EMERGED. FIRST, THE ATTACK HELICOPTER THREAT TO OUR FORWARD COMBAT FORCES IS ALREADY SEVERE AND GETTING WORSE. THE HELICOPTER TACTICS THAT LIMITED EFFECTIVENESS OF THE SGT YORK ARE CRITICAL ISSUES TO BE CONSIDERED IN ANY DIRECT FIRE REPLACEMENT SYSTEM, PARTICULARLY IF THAT SYSTEM CANNOT BE PROLIFERATED. SECOND, AIR DEFENSE ARTILLERY CANNOT COUNTER THE THREAT ALONE, AND NEITHER CAN THE OTHER ARMS -- INFANTRY, ARMOR, AVIATION, AND FIELD ARTILLERY. THE ARMY COMBINED ARMS TEAM AND A JOINT ARMY-AIR FORCE EFFORT ARE BOTH REQUIRED TO COMBAT THE CLOSE-IN AIR THREAT AND THE THREAT STANDING OFF AT LONGER RANGES. AIR DEFENSE ARTILLERY, WHILE CONTRIBUTING TO THE FIGHT AGAINST THE

CLOSE-IN HELICOPTER, MUST FOCUS ON COUNTERING THOSE HELICOPTERS OPERATING OUTSIDE THE RANGE OF THE COMBINED ARMS WEAPONS. ADDITIONALLY, AIR DEFENSE ARTILLERY MUST DEVELOP A CAPABILITY TO DESTROY ATTACK HELICOPTERS MASKED BY TERRAIN (NON-LINE-OF-SIGHT KILL) IN ENEMY TERRITORY. THIRD, WE MUST RELY ON AIR DEFENSE ARTILLERY AND THE AIR FORCE TO PROVIDE PROTECTION AGAINST THE FIXED WING THREAT TO OUR DIVISION AND CORPS FORCES DEPLOYED ACROSS THE BATTLEFIELD. THE FIXED WING THREAT TODAY IS PRIMARILY AIMED AT DESTROYING OUR SUSTAINMENT CAPABILITY AND DISRUPTING OUR COMMAND AND CONTROL. INDICATIONS ARE, HOWEVER, THAT IN THE FUTURE THE ENEMY FIXED WING AIRCRAFT WILL HAVE AN INCREASED CAPABILITY TO INFLICT SUBSTANTIAL DAMAGE ON OUR FORWARD FORCES, TO INCLUDE LIMITING OUR ABILITY TO MANEUVER THE RESERVES -- A KEY TO OUR SUCCESS IN BATTLE. LAST, A ROBUST COMMAND AND CONTROL SYSTEM IS REQUIRED. THE SYSTEM MUST EMPLOY A COMBINATION OF ACTIVE AND PASSIVE SENSORS THAT HAVE BOTH LINE-OF-SIGHT AND NON-LINE-OF-SIGHT CAPABILITIES. IN ADDITION, IT MUST WARN ALL COUNTER AIR CAPABLE ASSETS AND CUE AIR DEFENSE ARTILLERY WEAPONS TO IMPENDING THREAT AIRCRAFT.

<u>THREAT</u>

(U) IN FORMULATING THE FAAD SYSTEM, THE ARMY DID NOT WANT TO FALL INTO THE SAME CHANGING THREAT TRAP AS WITH THE SGT YORK. OUR GOAL WAS TO BE PROACTIVE WITH REGARD TO THE THREAT BY KEEPING AHEAD AND HAVING THE THREAT RESPOND TO OUR CAPABILITIES. WE MADE THE ASSUMPTION THE ENEMY WILL DO WHAT MAKES SENSE FOR HIM, AND THAT WE NEED NOT WAIT FOR HIM TO DEMONSTRATE A CAPABILITY IF THE CAPABILITY IS WELL WITHIN THE STATE OF THE ART. FOLLOWING ARE TRENDS THAT WE THINK ALL AIR FORCES WILL FOLLOW AND THAT OUR COUNTER AIR DEVELOPMENTS MUST ADDRESS. Chart 2

(U) USE OF SURFACE-TO-SURFACE MISSILES TO ATTACK SURFACE-TO-AIR MISSILE AND TACTICAL MISSILE LAUNCH SITES;

(U) USE OF LOW-OBSERVABLE TECHNIQUES, COUPLED WITH TRADITIONAL ELECTRONIC COUNTERMEASURES (ECM) TO SHORTEN THE RANGE OF RADIO FREQUENCY SURFACE-TO-AIR MISSILES;

(U) USE OF ANTI-RADIATION MISSILES TO ATTACK LOW DENSITY RADIO FREQUENCY SURFACE-TO-AIR MISSILES (E.G. PATRIOT, HAWK);

(U) INCREASED USE OF COUNTERMEASURES, SUCH AS SUPPRESSED PLUMES AND ACTIVE INFRARED COUNTERMEASURES, TO DEGRADE INFRARED SURFACE-TO-AIR MISSILES;

(U) EMPLOYMENT OF STANDOFF MISSILES FROM LOW-ALTITUDE HELICOPTERS OPERATING BEYOND COVERAGE OF FORWARD AREA AIR DEFENSE ARTILLERY AND COMBINED ARMS WEAPONS;

(U) USE OF STANDOFF DISPENSERS TO ATTACK STATIONARY TARGETS FROM DISTANCES BEYOND THE CAPABILITY OF SHORT RANGE POINT DEFENSE SYSTEMS; AND

(U) USE OF DRONES AND DECOYS TO SATURATE OR EXHAUST SURFACE-TO-AIR MISSILES AND USE OF UNMANNED PLATFORMS FOR SURVEILLANCE AND TARGET ACQUISITION.

(U) AS PREVIOUSLY STATED, OUR GOAL IN DEVELOPING OUR AIR DEFENSE PROGRAMS IS TO CAPITALIZE ON ENEMY WEAKNESSES AND BE PROACTIVE. THAT IS EXACTLY WHAT WE HAVE DONE IN FORMULATING THE FAAD SYSTEM. COMBINING THE FAAD SYSTEM CAPABILITIES WITH THOSE AT CORPS AND HIGHER ECHELONS WILL LEAVE THE ENEMY NO PREFERRED ATTACK OPTION. THIS COMBINATION WILL COMPLICATE HIS ATTACK AND FORCE HIM TO USE OPTIONS WITH A LOW PROBABILITY OF SUCCESS NO MATTER WHERE HE CHOOSES TO ATTACK ON THE BATTLEFIELD.

(U) A MORE DETAILED DISCUSSION OF THE SOVIET THREAT IS REQUIRED TO UNDERSTAND FULLY OUR COUNTER AIR REQUIREMENTS. SOVIET FORCES HAVE STEADILY EXPANDED AND UPGRADED EVERY CATEGORY OF THEIR

AERIAL WEAPONS SYSTEMS. SOVIET GROUND FORCE DIVISIONS AND AIR FORCE STRUCTURE ARE BEING REORGANIZED, ENLARGED, AND EQUIPPED WITH INCREASINGLY LETHAL AND MORE CAPABLE MISSILES, ARTILLERY, HELICOPTERS, AIRCRAFT, AND ELECTRONIC WARFARE SYSTEMS. Chart 3

(S) THE THREAT TO OUR FORCES IN THE FORWARD AREA INCLUDES BOTH ROTARY AND FIXED WING AIRCRAFT EMPLOYED IN A VARIETY OF ROLES AS WELL AS ARTILLERY AND ARMOR SYSTEMS. Deleted THESE CAPABILITIES WILL PERMIT THE THREAT, WITH SHORT EXPOSURE TIMES, TO EMPLOY ITS WEAPONRY OUT TO MAXIMUM RANGE AND TO LAUNCH FROM EXCEEDINGLY LOW ALTITUDES THEREBY TAKING ADVANTAGE OF TERRAIN MASKING AND GROUND CLUTTER.

(S) THE FIXED WING THREAT TO BE COUNTERED WILL INCLUDE HIGH PERFORMANCE AIRCRAFT OPERATING IN CLOSE AIR SUPPORT (CAS) ROLES NEAR THE FLOT; AIRCRAFT PERFORMING BATTLEFIELD AIR INTERDICTION (BAI); AND AIRCRAFT WITH MISSIONS REQUIRING THEM TO OVERFLY THE FORWARD-DEPLOYED MANEUVER FORCES INTO THE DIVISION REAR AREA. THESE AIRCRAFT WILL PRESENT THEMSELVES AT A VARIETY OF ALTITUDES, SPEEDS, AND ASPECTS. Deleted.

## EMPLOYMENT CONCEPT

(U) THE MISSION OF COUNTER AIR FORCES REMAINS THE SAME: Chart 4 DESTROY OR REDUCE THE EFFECTS OF THE AIR THREAT. IMPROVEMENTS TO THE AIR THREAT HAVE NECESSITATED A RELOOK OF OUR COUNTER AIR EMPLOYMENT CONCEPT. THE SPECIFIC TASKS INHERENT IN THE COUNTER AIR MISSION ARE TO KILL THE AIR THREAT (ON THE GROUND OR IN THE AIR) OR TO REDUCE ITS EFFECTIVENESS. REDUCING EFFECTIVENESS IS ACCOMPLISHED THROUGH BOTH ACTIVE AND PASSIVE MEASURES. ACTIVE MEASURES INCLUDE ACTIONS TO NULLIFY ENEMY WEAPONS CAPABILITIES, DISRUPT THE ENEMY'S COMMAND, CONTROL, AND COMMUNICATIONS MEANS, AND DESTROY ENEMY SUPPORT CAPABILITIES. PASSIVE MEASURES INCLUDE THE USE OF TERRAIN FOR COVER AND CONCEALMENT, DISPERSION

OF FORCES, AND REDUCTION OF RADIO FREQUENCY SIGNATURES.

(U) THE TRADITIONAL AIR DEFENSE ARTILLERY CONCEPT EVOLVED FROM THE OPERATIONAL CAPABILITIES OF INDIVIDUAL SYSTEMS AND WAS MODIFIED AS EACH NEW SYSTEM WAS FIELDED. THIS CONCEPT COULD BE CHARACTERIZED BY DESCRIPTORS SUCH AS REACTIVE, DEFENSE ORIENTED, CLUSTERS, OR ISLANDS OF DEFENSE. AIR DEFENSE MASS WAS CONCENTRATED AROUND CRITICAL ASSETS TO ENSURE ENGAGEMENT OF AIRCRAFT THAT ATTACKED THOSE ASSETS. THOUGH DESIRING TO KILL THE ATTACKING AIRCRAFT, REDUCING THE ORDNANCE DELIVERY EFFECTIVENESS AND DRIVING THEM AWAY WAS AN ACCEPTED RESULT OF THIS CONCENTRATION OF FIREPOWER. MULTIPLE, SIMULTANEOUS ENGAGEMENTS OF A SINGLE TARGET WAS THE ACCEPTED PRICE OF PROTECTING THE ASSET. MANUAL COMMAND AND CONTROL, MARGINAL FRONTAL ENGAGEMENT CAPABILITIES OF SHORT RANGE AIR DEFENSE (SHORAD) MISSILES, AND LIMITED NUMBERS OF GUNS PARTICIPATING IN THE AIR DEFENSE ROLE WERE THE REALITIES THAT DROVE THIS EMPLOYMENT CONCEPT.

(U) THE COMBINED ARMS COUNTER AIR CONCEPT AND THE FAAD SYSTEM ARE PRODUCTS DERIVED BY WORKING WITHIN A CONCEPT BASED REQUIREMENTS SYSTEM WHILE MAINTAINING TOUCH WITH THE REALITIES OF MANPOWER, BUDGET, AND TECHNOLOGICAL LIMITATIONS. THIS NEW CONCEPT CAN BE CHARACTERIZED BY DESCRIPTORS SUCH AS PROACTIVE, ATTRITION ORIENTED, AND DISPERSED BUT WEIGHTED. TO PROTECT THE GROUND FORCES FROM HOSTILE AIR EMPLOYING NEW, LONGER RANGE, MORE ACCURATE MUNITIONS AND INDIRECT FIRE DELIVERY TECHNIQUES, IT IS IMPERATIVE THAT WE BECOME MORE AGGRESSIVE. IN THE FORWARD AREA, WE MUST LOOK DEEPER AND LOWER INTO ENEMY AIRSPACE TO IDENTIFY AND KILL ENEMY AIRCRAFT PRIOR TO THEM ENGAGING THEIR TARGETS. IN THE REAR AREAS, WE MUST POSITIVELY IDENTIFY HOSTILE AIRCRAFT AND ENGAGE THEM AT GREATER DISTANCES FROM THE PROTECTED ASSETS. WHILE PROVIDING INCREASED DENSITY AROUND THE MOST CRITICAL ASSETS, SYSTEMS ARE LOCATED THROUGHOUT THE BATTLEFIELD IN ORDER

TO ENGAGE AND KILL ATTACKING AIRCRAFT PRIOR TO THEM REACHING THEIR ORDNANCE RELEASE POINTS. THIS DISPERSION PROVIDES FOR SEQUENTIAL ENGAGEMENTS OF AIRCRAFT AS THEY TRANSIT TOWARD TARGETS IN THE REAR. THE MISSILE SAVINGS REALIZED BY SEQUENTIAL VERSUS SIMULTANEOUS ENGAGEMENTS, THE INTELLIGENCE DENIAL BY NOT DISCLOSING PROTECTED ASSETS BY FIRING SIGNATURE, AND THE MULTIPLE ENGAGEMENT OF AIRCRAFT PRIOR TO ORDNANCE RELEASE ARE ADVANTAGES GAINED BY THE NEW EMPLOYMENT CONCEPT. THE COMPONENTS OF THE FAAD SYSTEM PROVIDE THE FOUNDATION UPON WHICH THIS INCREASED PROTECTION OF THE MANEUVER FORCES AND OUR WAR SUSTAINING ASSETS IS BASED. PROLIFERATED, COMPLEMENTARY, STATE-OF-THE-ART WEAPONS OPERATING UNDER THE UMBRELLA OF AN AUTOMATED COMMAND, CONTROL, AND INTELLIGENCE NETWORK -- ALL OF WHICH ARE INTEGRATED INTO THE MANEUVER ARMS SEGMENT OF THE COMBINED ARMS FORCE -- PROVIDE FOR DECREASED FRATRICIDE WHILE ADVERTISING TO THE THREAT, "YOU COME, YOU DIE".

## AIR DEFENSE PROGRAMS

(U) GIVEN OUR OVERALL EMPLOYMENT CONCEPT, THE TOTAL AIR DEFENSE FORCE CAN NOW BE DISCUSSED IN CONTEXT. CHART 5 FOR SIMPLICITY OF EXPLANATION, THE BATTLEFIELD CAN BE VIEWED AS A COLLECTION OF SEPARATE PIECES. THE TOTAL AIR DEFENSE SOLUTION, HOWEVER, IS A SYSTEM OF SUBSYSTEMS INTERLOCKED AND INTERWOVEN TO PROVIDE TOTAL COVERAGE AND TO PERMIT THE ENEMY NO PREFERRED ATTACK OPTION. THE PIECES TO BE DESCRIBED ARE ORGANIC TO THE DIVISIONS, CORPS, AND ECHELONS ABOVE CORPS (EAC). THE DIVISIONAL PIECE IS MADE UP OF THE FAAD SYSTEM COMPONENTS. HAWK, CHAPARRAL, AND OTHER NATIONAL GUARD WEAPON SYSTEMS MAKE UP THE CORPS PIECE WHILE EAC ELEMENTS CONSIST OF PATRIOT AND ANTI-TACTICAL MISSILE ASSETS. EACH SUBSYSTEM IS INTERNALLY CONNECTED BY COMMAND AND CONTROL ($C^2$)

SYSTEMS THAT EXTERNALLY INTERFACE WITH AIR DEFENSE AND COMBINED ARMS $C^2$.

DIVISION (FAAD) SYSTEMS

(U) IN THE FORWARD AREA, OUR PRESENT FAMILY OF WEAPONS (CHAPARRAL, STINGER, AND VULCAN) AND $C^2$ SYSTEMS, SEVERELY LIMIT OUR ABILITY TO CARRY OUT THE COUNTER AIR CONCEPT AND DEFEAT THE THREAT. THE FAAD SYSTEM, HOWEVER, IS A SYSTEM APPROACH THAT WILL GIVE US THE CAPABILITY NEEDED TO WIN. CHART 6 THE FAAD SYSTEM HAS FIVE COMPONENTS: COMMAND, CONTROL, AND INTELLIGENCE ($C^2I$), LINE-OF-SIGHT REAR (LOS-R), NON-LINE-OF-SIGHT (NLOS), LINE-OF-SIGHT FORWARD (LOS-F), AND COMBINED ARMS. EACH SYSTEM COMPONENT COMPLEMENTS THE OTHERS WITH THE RESULT BEING AN ARRAY THAT CAN DEFEAT ANY ENEMY ATTACK OPTION. THE DIFFERENT TECHNOLOGIES INHERENT IN MISSILES AND GUNS MAKE IT EXTREMELY DIFFICULT TO DEFEAT ANY ONE COMPONENT OF THE FAAD SYSTEM WITHOUT BEING ENGAGED BY ANOTHER.

(U) OFF THE SHELF EQUIPMENT AND TECHNOLOGY IS AVAILABLE, IN MANY CASES, TO MEET THE FAAD SYSTEM COMPONENT REQUIREMENTS. TO ACQUIRE THIS TOTAL SYSTEM AT THE LOWEST COST, A NONDEVELOPMENTAL ITEM (NDI) APPROACH WILL BE USED WHEN POSSIBLE. chart 7

(U) FAAD $C^2I$: THE FAAD COMMAND, CONTROL AND INTELLIGENCE (FAAD $C^2I$) COMPONENT--FORMERLY DESIGNATED THE SHORAD $C^2$ SYSTEM--WILL FUSE INTELLIGENCE AND TARGETING INFORMATION FROM ORGANIC SENSORS AND OTHER SOURCES. OTHER SPECIFIC BATTLEFIELD CONTRIBUTIONS INCLUDE ALERTING TO FAAD WEAPONS, COMBINED ARMS, AND HIGH-TO-MEDIUM AIR DEFENSE (HIMAD)/JOINT AIR DEFENSE ELEMENTS; CUEING TO FAAD WEAPONS (AND POTENTIALLY TO DESIGNATED COMBINED ARMS WEAPONS); AND PROVIDING THE CURRENT AIR SITUATION PICTURE TO FAAD AND COMBINED ARMS COMMANDERS. SIMPLY STATED, FAAD $C^2I$ IS THE "GLUE" THAT BINDS ALL THE COMPONENTS OF THE FAAD SYSTEM

TOGETHER. THIS COMPONENT ALSO WILL PROVIDE FOR INTEROPERABILITY OF FAAD WITH ALLIED, JOINT, AND HIMAD AIR DEFENSE $C^2$ SYSTEMS.

(U) LOW ALTITUDE AIRCRAFT IN THE BRIGADE AND DIVISION REAR AREAS ARE OFTEN MASKED FROM HIMAD AND JOINT SENSOR SURVEILLANCE. THE DELETION OF THE SGT YORK SENSORS HAS FURTHER COMPLICATED THE SURVEILLANCE AND IDENTIFICATION PROBLEM OVER THE FORWARD AREA OF THE BATTLEFIELD. TO FILL THIS VOID, A NETWORK CONSISTING OF ACTIVE AND PASSIVE AERIAL AND GROUND-BASED SENSORS IS REQUIRED TO DETECT AND IDENTIFY THREAT AIRCRAFT. THESE SENSORS MUST COVER THE ENTIRE DIVISION AREA AND 20 TO 30 KILOMETERS FORWARD OF THE FORWARD LINE OF OWN TROOPS (FLOT). MOBILE ACTIVE GROUND-BASED SENSORS ALLOW US TO INTEGRATE TARGETING INFORMATION FROM JOINT, ALLIED, AND HIMAD SOURCES AND TO MEET THE REQUIREMENT TO SEARCH FOR, TRACK, AND REPORT ACCURATE TARGET LOCATIONS IN AN ECM ENVIRONMENT. THESE SENSORS WILL PROVIDE THE NEEDED LOW ALTITUDE COVERAGE OVER THE BRIGADE AND DIVISION REAR AREAS WHERE JOINT AND HIMAD DETECTION AT LOW ALTITIUDES IS LIMITED. A SMALL NUMBER OF LIGHTWEIGHT AERIAL SENSORS CAN PROVIDE DETECTION OF TERRAIN-MASKED TARGETS FORWARD OF THE FLOT. THIS CAPABILITY IS NEEDED TO IMPROVE OUR NON-LINE-OF-SIGHT WEAPONS' ABILITY TO ENGAGE, PARTICULARLY IN ENEMY TERRITORY. THESE AERIAL SENSORS, WHICH WILL COMPLEMENT OUR GROUND SENSORS, WILL ALSO ENABLE US TO EXPLOIT THE FULL CAPABILITIES OF OUR FAAD WEAPON SYSTEMS.

(U) THE INCORPORATION OF PASSIVE TECHNOLOGIES SUCH AS NON-COOPERATIVE TARGET RECOGNITION (NCTR), WILL PROVIDE POSITIVE HOSTILE AIRCRAFT IDENTIFICATION (PHAID). NCTR TECHNOLOGIES THAT USE THE ENTIRE SIGNATURE SPECTRUM OF THREAT AIRCRAFT WILL ALLOW ENGAGEMENTS BEYOND VISUAL RANGE. IN ADDITION, THESE TECHNOLOGIES WILL LIKELY PROVIDE A PASSIVE TARGET ACQUISITION CAPABILITY FOR OUR AERIAL AND GROUND SENSORS AND FAAD WEAPON SYSTEMS, THEREBY ENABLING US TO REMAIN SILENT WITH OUR ACTIVE SENSORS. Chart 8

(U) THE FY87 BUDGET REQUEST OF $122.2 MILLION RESEARCH, DEVELOPMENT, TESTING, AND EVALUATION (RDT&E): SUPPORTS THE ARMY'S NEED TO AWARD THE SOFTWARE FULL SCALE DEVELOPMENT CONTRACT FOR FAAD $C^2I$ DEVELOPMENT; TO PREPARE FOR AND CONDUCT A DEMONSTRATION AND EVALUATION FOR A NONDEVELOPMENTAL ITEM SENSOR; TO CONDUCT PASSIVE IDENTIFICATION DEMONSTRATIONS; AND TO COMPLETE AERIAL SENSOR SYSTEM DEFINITION. THE TEST BED SYSTEM LOCATED AT FT LEWIS WILL CONTINUE TO BE USED TO COLLECT AND EVALUATE DATA TO FEED THE OBJECTIVE FAAD $C^2I$ COMPONENT.

(U) LOS-R: THE SECOND COMPONENT OF THE FAAD SYSTEM IS THE LINE-OF-SIGHT REAR (LOS-R), BETTER KNOWN AS PEDESTAL MOUNTED STINGER (PMS). THIS COMPONENT WILL BE THE MOST PROLIFERATED FAAD WEAPONS AND WILL BE DEPLOYED IN THE BRIGADE REAR AND DIVISION AND CORPS AREAS. ITS COST SHOULD BE MINIMAL BECAUSE WE WILL USE A NONDEVELOPMENT ITEM (NDI) ACQUISITION APPROACH THAT INCLUDES COMPETITIVE PROCUREMENTS.

(U) BASIC STINGER IS A MANPORTABLE, SHOULDER-FIRED MISSILE SYSTEM WHICH USES A PASSIVE INFRARED HOMING SYSTEM TO GUIDE ON THE TARGET. AN IMPROVED SEEKER EMPLOYING A PASSIVE OPTICAL SEEKER TECHNIQUE (POST) HAS BEEN PHASED INTO PRODUCTION, AND FINAL DELIVERIES WILL BE COMPLETED DURING FISCAL YEAR 1987. POST IMPROVES STINGER PERFORMANCE IN AN INFRARED COUNTERMEASURE ENVIRONMENT BY THE ADDITION OF A NEW SCANNING TECHNIQUE AND AN ULTRAVIOLET SEEKER CHANNEL. DEVELOPMENT OF A REPROGRAMMABLE MICROPROCESSOR (RMP) WAS INITIATED IN 1984 TO ADDRESS THE MOST SOPHISTICATED INFRARED/JAMMER THREAT. THIS IMPROVEMENT ALLOWS SOFTWARE CHANGES TO THE STINGER MISSILE TO OVERCOME FUTURE THREATS WITHOUT COSTLY RETROFIT, THEREBY EXTENDING THE USEFUL LIFE OF THE SYSTEM. RMP WAS CUT INTO PRODUCTION IN FISCAL YEAR 1985.

(U) PMS WILL BE A STINGER BASED MISSILE SYSTEM WITH EIGHT READY-TO FIRE MISSILES MOUNTED ON A HIGH MOBILITY MULTIPURPOSE

WHEELED VEHICLE (HMMWV). THIS SYSTEM WILL IMPROVE THE MAN-MACHINE INTERFACE PROBLEMS ASSOCIATED WITH STINGER EMPLOYMENT IN A MANPADS CONFIGURATION. WITH THE ADDITION OF DIRECT VIEW OPTICS, A FORWARD LOOKING INFRARED DEVICE, AND A LASER RANGEFINDER, THE GUNNER WILL BE ABLE TO MAXIMIZE THE STINGER MISSILE'S ENGAGEMENT CAPABILITY. EXISTING STINGER MISSILES CAN BE FIRED FROM THE PMS SYSTEM WITHOUT MODIFICATION. PMS WILL COUNTER FIXED-WING AIRCRAFT AND HELICOPTERS AND, BECAUSE OF ITS EMPLOYMENT LOCATIONS, WILL REQUIRE LESS MOBILITY AND ARMOR PROTECTION THAN OTHER SYSTEMS IN HEAVY DIVISIONS THAT USUALLY FIGHT NEAR THE FRONT IN RANGE OF ENEMY DIRECT FIRE WEAPONS. WE WILL PROCURE PMS THROUGH FULL AND OPEN COMPETITION AS DIRECTED BY THE CONGRESS IN FY86.

(C) THE REQUIREMENTS DOCUMENT FOR PMS IS SLATED FOR DEPARTMENT OF THE ARMY APPROVAL IN MARCH 1986. THIS APPROVAL WILL ENABLE A REQUEST FOR PROPOSAL TO BE RELEASED IN APRIL 1986. THE ARMY IS CONFIDENT THAT AFTER THE COMPETITIVE EVALUATION THIS FALL, WE CAN ACHIEVE AN INITIAL OPERATIONAL CAPABILITY (IOC) WITH PMS BY Deleted

Chart 9

(U) THIS YEAR'S $6.3 MILLION RDT&E REQUEST IS TO COMPLETE STINGER RMP DEVELOPMENT AND TO SUPPORT PMS SOURCE SELECTION. THE $293 MILLION PROCUREMENT REQUEST IS FOR THE PURCHASE OF 4180 RMP CONFIGURED STINGER MISSILES AND GROUND SUPPORT EQUIPMENT; ADVANCED PROCUREMENT FOR A FIVE YEAR MULTI-YEAR BUY; AND LOW RATE INITIAL PRODUCTION OF PMS. THE FY87 MISSILE BUY WILL BRING US TO APPROXIMATELY 40 PERCENT OF OUR STINGER AUTHORIZATION OBJECTIVE.

(U) NLOS: THE THIRD ELEMENT OF THE FAAD SYSTEM IS THE NON-LINE-OF-SIGHT (NLOS) COMPONENT. THE NLOS COMPONENT WILL BE DEPLOYED IN DEFILADE NEAR THE FLOT MASKED FROM VISUAL DETECTION BY THE ENEMY. THIS WEAPON WILL GIVE THE ARMY AN AIR DEFENSE ARTILLERY CAPABILITY TO DEFEAT HELICOPTERS BEHIND MASK. IT WILL ALSO ALLOW US TO ENGAGE ENEMY HELICOPTERS BEFORE THEY ARE CAPABLE OF ENGAGING US.

(U) THE FIBER OPTIC GUIDED MISSILE (FOG-M) IS ONE OF THE LEADING CANDIDATES FOR NLOS. FOG-M IS A PRECISION GUIDED MISSILE DEVELOPED IN HOUSE BY THE ARMY MISSILE COMMAND'S RESEARCH, DEVELOPMENT, AND ENGINEERING CENTER. IT USES AN IMAGING SEEKER FOR TARGET ACQUISITION, TRANSMITS THE IMAGE FROM THE MISSILE TO AN OPERATOR ON THE FOG-M VEHICLE THROUGH A FIBER OPTIC DATA LINK, AND RECEIVES STEERING SIGNALS BACK THROUGH THE LINK TO CONTROL MISSILE FLIGHT TO TARGET IMPACT. IN ADDITION TO ITS AIR DEFENSE CAPABILITY, FOG-M WILL BE ABLE TO KILL STATIONARY OR MOVING TANKS. THE FIRE UNIT WILL BE MOUNTED ON A STANDARD FIGHTING VEHICLE SYSTEM CARRIER AND MANNED BY A CREW OF THREE.

(U) THE ARMY IS CURRENTLY INVESTIGATING OTHER NLOS ALTERNATIVES SUCH AS THE US AIR FORCE'S ADVANCED MEDIUM RANGE AIR-TO-AIR MISSILE (AMRAAM). OUR INITIAL LOOK AT AMRAAM, HOWEVER, INDICATES IT PROBABLY IS BETTER SUITED FOR OTHER MISSIONS.

(U) AS TECHNOLOGY CURRENTLY EXISTS TO COUNTER THE LOW ALTITUDE, HOVERING HELICOPTER THREAT, AN ACCELERATED ACQUISITION STRATEGY WILL BE FOLLOWED. TO FIND OUT MORE ABOUT THE LEADING CANDIDATE, THE ARMY INTENDS TO BUY A PLATOON OF FOG-M WEAPON SYSTEMS AND TEST THEM IN AN OPERATIONAL ENVIRONMENT. THE RESULTS OF THE TESTING COUPLED WITH ANALYSIS RESULTS WILL ALLOW THE ARMY TO ENSURE THE DESIGN FULLY MEETS THE PROJECTED THREAT IN A VARIETY OF BATTLEFIELD SITUATIONS. CHART 10 OUR FY87 BUDGET REQUEST OF $83.3 MILLION IN RDT&E IS TO EVALUATE NLOS ALTERNATIVES, ENHANCE THE BASIC FOG-M DESIGN, AND TO TEST FOG-M IN AN OPERATIONAL ENVIRONMENT.

(U) <u>LOS-F</u>: THE FOURTH COMPONENT OF THE FAAD SYSTEM IS THE LINE-OF-SIGHT-FORWARD (LOS-F) ELEMENT WHICH WILL BE EMPLOYED IN THE CLOSE COMBAT ZONE OF BOTH THE HEAVY AND LIGHT DIVISIONS. THERE ARE TWO VARIANTS OF THIS COMPONENT - A TRACKED VARIANT FOR THE HEAVY DIVISION AND A WHEELED VARIANT FOR THE LIGHT DIVISION. THE VARIANTS WILL BE DESIGNED TO KILL AND SUPPRESS ENEMY FIXED

WING AIRCRAFT AND EXPOSED HELICOPTERS. THEY WILL ALSO BE CAPABLE OF OPERATING AT NIGHT AND ENGAGING HELICOPTERS IN GROUND CLUTTER. A GUN/MISSILE MIX IS THE ENVISIONED SYSTEM CONFIGURATION FOR BOTH VARIANTS AS IT CAPITALIZES ON THE STRENGTHS OF BOTH WEAPON TYPES. GUNS ARE EFFECTIVE AT SHORT RANGES BY CAUSING FIXED WING AIRCRAFT TO JINK OR FLY HIGHER AND CAUSING HELICOPTERS TO MASK, THEREBY REDUCING THE ENGAGEMENT OPPORTUNITIES OF EACH. MISSILES ARE EFFECTIVE AT LONGER RANGES AND ARE MORE RESPONSIVE TO MANEUVERING AIRCRAFT. TO SATISFY A GUN/MISSILE MIX IN THE HEAVY DIVISION, OUR APPROACHES FALL INTO THREE BROAD CATEGORIES:

(U) A HYBRID CONSISTING OF AN AIR DEFENSE MISSILE AND AIR DEFENSE GUN ON THE SAME VEHICLE;

(U) A MIX CONSISTING OF AN AIR DEFENSE MISSILE AND AIR DEFENSE GUN ON SEPARATE VEHICLES;

(U) AN AIR DEFENSE MISSILE-ONLY SYSTEM, WITH COMBINED ARMS GUNS IN THEIR AIR DEFENSE ROLES PROVIDING THE GUN COMPONENT.

(U) A REQUEST FOR INFORMATION (RFI) WAS RELEASED IN JANUARY 1986 TO SOLICIT FROM INDUSTRY INFORMATION ON SOLVING THE LINE-OF-SIGHT FORWARD (HEAVY) PROBLEM. A DEMONSTRATION IS PLANNED IN THE FALL OF 1986 TO VERIFY DATA AND CONTRACTOR CLAIMS. SYSTEM SELECTION IS SCHEDULED FOR MARCH 1987.

(U) TO SATISFY THE MIX REQUIREMENT IN THE LIGHT DIVISION, WE ARE PLANNING TO PRODUCT IMPROVE THE PMS BY THE ADDITION OF A DEDICATED AIR DEFENSE GUN AND A COMPLEMENTARY MISSILE FOR THE PURPOSE OF ENGAGING TARGETS IN INFRARED CLUTTER. SPECIFIC SYSTEM CHARACTERISTICS ARE BEING REFINED AND ARE PROJECTED TO BE FINALIZED BY THE END OF FY86.

CHART 11 ~~(U)~~ THE BUDGET REQUEST OF $21.7 MILLION RDT&E FOR THE LIGHT VARIANT IS TO BEGIN DEVELOPMENT OF PREVIOUSLY DISCUSSED PRODUCT IMPROVEMENTS FOR PMS. IN ADDITION, ON-BOARD SENSOR CAPABILITIES WILL BE IMPROVED. CHART 12 THE $20.6 MILLION RDT&E FOR THE HEAVY VARIANT

IS FOR DEMONSTRATION, EVALUATION AND SOURCE SELECTION. THE $9.1 MILLION IN PROCUREMENT IS TO BUY LONG-LEAD PRODUCTION ITEMS FOR THE HEAVY VARIANT. AN IOC FOR BOTH VARIANTS COULD BE ATTAINED AS EARLY AS [redacted]

(U) <u>COMBINED ARMS</u>: THE FINAL COMPONENT OF THE FAAD SYSTEM IS THE JOINT AND COMBINED ARMS' CONTRIBUTION TO COUNTER THE ENEMY AIR THREAT IN THE FORWARD AREA. THE PRIMARY MISSION OF COMBINED ARMS WEAPONS MUST REMAIN FOCUSED ON THE ENEMY GROUND THREAT. HOWEVER, SOME CAPABILITY TO ENGAGE ROTARY WING AIRCRAFT DOES EXIST AND SHOULD BE EXPLOITED. THESE CONTRIBUTIONS HAVE BEEN IDENTIFIED AND ARE BEING ANALYZED FURTHER. INITIATIVES BEING TAKEN INCLUDE GIVING THE AIR FORCE THE MISSION TO DEFEAT STANDOFF JAMMERS; ENHANCING TANK AMMUNITION TO COUNTER HELICOPTERS; ACCELERATING THE DELIVERY OF AIR-TO-AIR STINGER; AND EVALUATING AIR DEFENSE EFFECTIVENESS OF THE GUNS CURRENTLY ON TANKS AND BRADLEY FIGHTING VEHICLES.

<u>CORPS SYSTEMS</u> CHART 13

(U) CORPS AIR DEFENSE ASSETS WILL BE PRIMARILY CHAPARRAL AND HAWK. CHAPARRAL FIRE UNITS WILL BE WITHDRAWN FROM THE FORWARD DIVISIONS AND MOVED TO THE CORPS AIR DEFENSE ARTILLERY BRIGADES. THESE CHAPARRAL AND HAWK BRIGADE UNITS WILL BE EMPLOYED TO PROTECT CORPS PRIORITY ASSETS AND TO REINFORCE FORWARD ASSETS AS REQUIRED.

(U) <u>CHAPARRAL</u>: THE CHAPARRAL IS A LOW ALTITUDE, SHORT RANGE MISSILE SYSTEM EFFECTIVE AGAINST BOTH HELICOPTERS AND FIXED WING AIRCRAFT. THE MAJOR COMPONENTS OF THE CHAPARRAL WEAPON SYSTEM ARE THE TRACKED VEHICLE AND GROUND EMPLACEMENT HARDWARE AND THE GUIDED MISSILE LAUNCHING STATION. THE LAUNCHING STATION, WHICH MAY BE OPERATED AS AN INDEPENDENT UNIT, CONTAINS ALL THE EQUIPMENT NECESSARY FOR TARGET TRACKING AND MISSILE LAUNCHING PLUS STORAGE SPACE FOR ADDITIONAL MISSILES. CHAPARRAL IS AN INFRARED (IR) HOMING, FIRE-AND-FORGET SYSTEM, THAT INCLUDES FOUR

READY MISSILES ON LAUNCH RAILS AND AN ADDITIONAL EIGHT MISSILES IN STORAGE COMPARTMENTS UNDER THE DECK OF THE LAUNCHING STATION. THE GUNNER IS IN A POWERED COCKPIT EQUIPPED WITH AN IDENTIFICATION-FRIEND-OR-FOE (IFF) SYSTEM, AN OPTICAL DAYLIGHT SIGHT, AND A FORWARD LOOKING INFRARED (FLIR) ACQUISITION AND TRACKING SYSTEM THAT PROVIDES THE SYSTEM WITH A NIGHT OPERATIONAL FIRING CAPABILITY. SYSTEM ENGAGEMENT CAPABILITY AT ALL TARGET ASPECTS IS LIMITED BY THE ABILITY OF THE CREW TO ACQUIRE AND IDENTIFY THE TARGET.

(U) THE SYSTEM WAS FIELDED IN 1969 AND WILL REMAIN IN THE FORCE TO SUPPORT BOTH THE ACTIVE ARMY AND THE NATIONAL GUARD. IN ADDITION, FOUR ALLIED NATIONS CURRENTLY EMPLOY THE CHAPARRAL SYSTEM.

(U) THE ARMY HAS COMPLETED FIELDING OF ITS FIRST ARMY NATIONAL GUARD (ARNG) CHAPARRAL BATTALION AT ROSWELL, NEW MEXICO, AND HAS DELIVERED EQUIPMENT FOR THE FIRST BATTERY IN THE SECOND BATTALION AT TUCUMCARI, NEW MEXICO. WE WILL COMPLETE THE FILL OF THE SECOND BATTALION IN FY87 FOLLOWED BY THE ACTIVATION OF A THIRD BATTALION IN ITS ENTIRETY IN FY88 AT ALBUQUERQUE, NEW MEXICO. A FOURTH BATTALION WILL BE ACTIVATED IN FY89 AT LAS CRUCES, NEW MEXICO. EQUIPMENT FOR TWO OTHER CHAPARRAL BATTALIONS ARE PROJECTED TO BE DELIVERED IN FY90 AND WILL ENABLE US TO PHASE OUT THE ROLAND BATTALION AT MCGREGOR RANGE, FORT BLISS, TEXAS. THESE TWO CHAPARRAL BATTALIONS WILL BE STATIONED AT BELN AND CLAYTON, NEW MEXICO, RESPECTIVELY.

(U) THE CHAPARRAL SYSTEM HAS RECENTLY BEEN IMPROVED TO KEEP IT EFFECTIVE AGAINST THE GROWING THREAT. THE ADDITION OF A FORWARD LOOKING INFRARED SENSOR MOUNTED IN THE LAUNCHING STATION GREATLY ENHANCES THE EFFECTIVENESS OF THE TARGET ACQUISITION CAPABILITY DURING DAYLIGHT, ADVERSE WEATHER, AND NIGHT OPERATIONS. AN IMPROVED MISSILE WAS FIELDED TO PROVIDE AN ALL ASPECT

ENGAGEMENT CAPABILITY. A MINIMAL SMOKE ROCKET MOTOR IS BEING DEVELOPED TO REDUCE THE MISSILE SIGNATURE, WHICH IN TURN WILL INCREASE THE SURVIVABILITY OF THE CREW AND THE EQUIPMENT. LASTLY, A MORE RELIABLE FUZE AND A WARHEAD WITH IMPROVED LETHALITY HAVE BEEN PROVIDED.

Deleted. THE EXTENDED ACQUISITION RANGE IS NEEDED TO IMPROVE CHAPARRAL'S CAPABILITY AGAINST INCOMING FIXED WING TARGETS AND AGAINST HELICOPTERS USING STANDOFF WEAPONS.

Deleted. THIS MISSILE WILL BE OPERATIONALLY IDENTICAL TO THE EXISTING MISSILE AND WILL REQUIRE NO CHANGES TO THE FIRE UNIT OR CURRENT FIRING PROCEDURES.

CHART 14

(U) THE FY87 RESEARCH AND DEVELOPMENT FUNDS OF $5.6 MILLION ARE NEEDED TO COMPLETE DEVELOPMENT OF THE ROSETTE SCAN SEEKER MISSILE. THE PROCUREMENT REQUEST OF $111.6 MILLION IS NEEDED TO PROCURE 456 ROSETTE SCAN SEEKER MISSILES, TO PROCURE FORWARD LOOKING INFRARED NIGHT SIGHTS, AND 524 MINIMAL SMOKE ROCKET MOTORS.

(U) HAWK: THE HAWK MISSILE SYSTEM IS THE MOST PROLIFERATED, TIME TESTED AIR DEFENSE WEAPON SYSTEM IN THE FREE WORLD. ITS WORLDWIDE ACCEPTANCE IS ATTRIBUTED TO ITS PERFORMANCE IN THE 1973 MIDEAST WAR. THERE, IN AN UNIMPROVED CONFIGURATION, THE HAWK SYSTEM DESTROYED OVER TWENTY MIGS AND OTHER AIRCRAFT. TWENTY-ONE ALLIED NATIONS HAVE PROCURED THE SYSTEM, AND SEVERAL OTHERS HAVE EXPRESSED AN INTEREST. ALTHOUGH PATRIOT WILL REPLACE SOME ARMY HAWK UNITS, THE HAWK SYSTEM WILL REMAIN DEPLOYED, PRIMARILY IN THE CORPS AREA.

(U) THE HAWK GUIDED MISSILE SYSTEM IS DESIGNED TO DETECT AND DESTROY LOW TO MEDIUM ALTITUDE HOSTILE AIRCRAFT. THE SYSTEM HAS BEEN CONTINUALLY IMPROVED BY INCORPORATING ADVANCED TECHNOLOGY. MAJOR COMPONENTS ARE TRAILER MOUNTED TO GIVE THE SYSTEM

OPERATIONAL MOBILITY. THE SYSTEM HAS THE CAPABILITY TO SEARCH, DETECT, IDENTIFY, EVALUATE, AND ENGAGE HOSTILE TARGETS AUTOMATICALLY. IT IS BEING RECONFIGURED TO INCREASE MOBILITY AND TO DECREASE MANPOWER REQUIREMENTS. PLANNED PRODUCT IMPROVEMENTS WILL UPGRADE THE PERFORMANCE OF THE HAWK SYSTEM TO MEET THE PROJECTED THREAT TO THE YEAR 2000. THE SYSTEM WILL HAVE A BUILT-IN TRAINING CAPABILITY, IMPROVED RELIABILITY AND MOBILITY, GREATER EFFECTIVENESS AGAINST JAMMING, BETTER SURVIVABILITY ON THE BATTLEFIELD, AND AN ENHANCED MULITPLE SIMULTANEOUS TARGET ENGAGEMENT CAPABILITY AGAINST SATURATION ATTACKS.

(U) THE PROGRAM FOR ACTIVATING HAWK BATTALIONS IN THE ARNG REMAINS ON SCHEDULE WITH ACTIVATION OF THE FIRST BATTALION SCHEDULED FOR FY87 IN ALBUQUERQUE, NEW MEXICO. THE CONTINUED INACTIVATION OF ACTIVE COMPONENT HAWK UNITS AS A RESULT OF THE PATRIOT BUILD-UP WILL ENABLE US TO FIELD TWO MORE ARNG HAWK BATTALIONS BEFORE THE END OF FY90. THE FIELDING DECISION HAS BEEN MADE TO STATION THESE BATTALIONS AT WEST PALM BEACH, FLORIDA, AND ATHENS, OHIO, RESPECTIVELY. EXCESS EQUIPMENT IS ALSO BEING TRANSFERRED TO THE U.S. MARINE CORPS IN SUPPORT OF THEIR INCREASING HAWK FORCE STRUCTURE.

CHART 15

(U) RESEARCH AND DEVELOPMENT FUNDS OF $10.6 MILLION WILL CONTINUE DEVELOPMENT OF FIELD MAINTENANCE EQUIPMENT IMPROVEMENTS AND A MISSILE ECCM MODIFICATION TO COUNTER THE JAMMER THREAT. THE PROCUREMENT REQUEST OF $83.2 MILLION WILL BE USED TO OBTAIN THE MODIFICATION KITS TO SUPPORT THE PRODUCT IMPROVEMENTS DESCRIBED PREVIOUSLY AND TO PROCURE ROCKET MOTORS TO REPLACE THOSE WHOSE SHELF LIVES HAVE EXPIRED.

(U) HIMAD-C$^2$ (AN/TSQ-73): MAXIMUM EFFECTIVENESS OF AIR DEFENSE ARTILLERY FOR JOINT OR COMBINED FORCES IS ACHIEVED THROUGH INTEGRATION AND INTEROPERABILITY. TO OPTIMIZE WEAPON SYSTEM EFFECTIVENESS, AIR DEFENSE FORCES FOLLOW RULES AND

PROCEDURES THAT ALLOW FOR CENTRALIZED DIRECTION OF THE TOTAL AIR BATTLE BUT PERMIT DECENTRALIZED EXECUTION. THE AN/TSQ-73 MISSILE MINDER IS AN AUTOMATED COMMAND AND CONTROL SYSTEM THAT SERVES AS THE BRIGADE AND BATTALION FIRE DIRECTION CENTERS (FDC'S) FOR HAWK AND THE BRIGADE FDC FOR PATRIOT. WHEN APPROPRIATE THE BRIGADE AND BATTALION AN/TSQ-73 INTERFACE WITH CONTROLLING AIR FORCE REGION COMMANDERS. REAL-TIME DISTRIBUTION OF WEAPONS CONTROL, FIRE UNIT STATUS, AND TARGETING INFORMATION IS PROVIDED VIA DIGITAL DATA LINKS BY THE AN/TSQ-73 TO OTHER SYSTEMS AND TO HAWK AND PATRIOT UNITS.

(U) THE AN/TSQ-73 SYSTEM IS BEING UPGRADED TO ENHANCE INTEROPERABILITY. THE SYSTEM IMPROVEMENT PROVIDES A DIRECT JOINT TACTICAL INFORMATION DISTRIBUTION SYSTEM (JTIDS) INTERFACE WITH SUBORDINATE HAWK PLATOON COMMAND POSTS, FAAD C$^2$I SYSTEMS, AND AIRBORNE JTIDS-EQUIPPED SYSTEMS (SUCH AS THOSE IN THE AIR FORCE). THIS IMPROVEMENT WILL ALSO PROVIDE FOR A SINGLE CHANNEL ENCRYPTION CAPABILITY BETWEEN JOINT SERVICE INTERFACES AND AIR DEFENSE ARTILLERY BRIGADE AND BATTALION LEVEL FDC'S USING HOST NATION COMMUNICATIONS OR OTHER TACTICAL COMMUNICATIONS SUCH AS TROPOSCATTER RADIO. THE $10.6 MILLION WE REQUESTED IN RESEARCH AND DEVELOPMENT FUNDS SUPPORTS THESE IMPROVEMENTS.

CHART 16

ECHELONS ABOVE CORPS (EAC) SYSTEMS

(U) AT ECHELONS ABOVE CORPS, THE ARRAY OF AIR DEFENSE SYSTEMS WILL PRIMARILY CONSIST OF PATRIOT FIRING BATTALIONS. INCLUDED IN DEPLOYMENT CONSIDERATIONS WILL BE THE CONTRIBUTION OF HAWK UNITS UNDER CORPS CONTROL AND THE SHORT RANGE AIR DEFENSE UNITS LOCATED AROUND THE AIR BASES.

(U) PATRIOT: PATRIOT HAS REPLACED THE NIKE HERCULES MISSILE SYSTEM AND SOME HAWK SYSTEMS. PATRIOT IS A LONG RANGE, SURFACE-TO-AIR MISSILE SYSTEM THAT UTILIZES ADVANCED TECHNOLOGY

TO ACHIEVE EFFECTIVE AIR DEFENSE AGAINST THE KNOWN THREAT. THE SYSTEM IS DESIGNED TO REDUCE MANPOWER REQUIREMENTS AND TO IMPROVE MAINTAINABILITY OVER OLDER SYSTEMS. A MULTIFUNCTION, PHASED ARRAY RADAR THAT IS AUTOMATICALLY CONTROLLED BY A COMPUTER IS USED BY THE SYSTEM TO ENGAGE HOSTILE AIRCRAFT WITH A HIGH PROBABILITY OF INTERCEPT, EVEN IN AN ELECTRONIC COUNTERMEASURE ENVIRONMENT. EACH PATRIOT MISSILE LAUNCHING STATION CONTAINS FOUR READY MISSILES SEALED IN A CANISTER. PATRIOT MISSILES DO NOT REQUIRE FIELD MAINTENANCE. BATTERIES CONTAIN UP TO EIGHT TRAILER MOUNTED MISSILE LAUNCHERS THAT ARE WIDELY DISPERSED FOR SURVIVABILITY ON THE MODERN BATTLEFIELD. THE SYSTEM HAS A FULL AUTOMATIC CAPABILITY DESIGNED TO REDUCE REACTION TIME AND CAN DETECT, TRACK, AND PRIORITIZE AIRBORNE TARGETS AUTOMATICALLY. IT IS CAPABLE OF FIRING AND GUIDING SEVERAL MISSILES SIMULTANEOUSLY TO MULTIPLE THREAT TARGETS. ALTHOUGH THE SYSTEM IS AUTOMATIC, OPERATORS ALWAYS HAVE THE OPTION OF OVERRIDING COMPUTER DECISIONS AND MANUALLY OPERATING THE SYSTEM.

(U) AS ONE OF THE ARMY'S BIG FIVE SYSTEMS, PATRIOT IS A TRUE SUCCESS STORY. THE SYSTEM COMPLETED THE FOLLOW-ON EVALUATION III IN SEPTEMBER 1984. CREWS WERE EFFECTIVELY TRAINED, AND ALL TEST ISSUES WERE MET OR EXCEEDED. FOUR MISSILES WERE FIRED UNDER TACTICAL BATTLEFIELD COUNTERMEASURES CONDITIONS, AND FOUR FULL SCALE TARGETS WERE INTERCEPTED AND DESTROYED. MILESTONE III REQUIREMENTS WERE MET AND ON 4 NOV 84 THE SECRETARY OF DEFENSE DIRECTED THE DEPLOYMENT OF THE FIRST PATRIOT BATTALION TO EUROPE. THE FIRST FULLY TRAINED BATTALION WAS DEPLOYED AND DECLARED READY FOR ITS NATO MISSION IN EARLY 1985. THE SECOND BATTALION WAS DEPLOYED IN AUGUST 1985, AND ITS ACCEPTANCE INTO THE NATO FORCES IN EVERY WAY EXCEEDED THAT OF THE FIRST BATTALION.

CHART 17

(U) FOR FISCAL YEAR 1987, PATRIOT WILL ENTER ITS EIGHTH YEAR OF PRODUCTION. THIS YEAR'S PROCUREMENT REQUEST IS THE FIRST YEAR OF A FIVE YEAR MULTI-YEAR PROPOSAL WHICH WILL, IF APPROVED BY THE CONGRESS, COMPLETE THE BUY OUT OF THE PATRIOT SYSTEM AND PRODUCE SIGNIFICANT SAVINGS OVER SINGLE YEAR PROCUREMENTS. WE HAVE ALREADY REDUCED THE PATRIOT FIVE YEAR PROCUREMENT PROGRAM BY MORE THAN $300 MILLION TO REFLECT THE MULTI-YEAR SAVINGS. IN ADDITION, OUR NATO ALLIES WILL SHARE ADDITIONAL SAVINGS, BECAUSE THE KNOWN FOREIGN MILITARY SALES REQUIREMENTS ARE INCLUDED IN OUR MULTI-YEAR STRATEGY.

CHART 18

(U) THE SUCCESS OF PATRIOT INTERNATIONAL PROGRAMS IS INDICATIVE OF THE SUPERB REPUTATION THE SYSTEM HAS GAINED IN A SHORT PERIOD OF TIME. PROCUREMENT OF PATRIOT BY OUR ALLIES BEGAN IN FEBRUARY 1984 WHEN THE NETHERLANDS SIGNED A FOREIGN MILITARY SALES AGREEMENT FOR 4 FIRE UNITS AND 160 MISSILES.

(U) IN JULY 1984 THE SECRETARY OF DEFENSE AND THE MINISTER OF DEFENSE FOR THE FEDERAL REPUBLIC OF GERMANY (FRG) IMPLEMENTED AN EARLIER AGREEMENT ON COOPERATIVE MEASURES FOR ENHANCING AIR DEFENSE IN CENTRAL EUROPE. AS PART OF THIS AGREEMENT, THE FRG WILL BUY 14 PATRIOT FIRE UNITS. IN ADDITION, THE FRG WILL BUY AND MAN 27 GERMAN ROLAND FIRE UNITS TO INTEGRATE INTO THE US AIR BASE DEFENSE SYSTEM AND ALSO WILL MAN, OPERATE, AND SUPPORT 12 US-OWNED PATRIOT FIRE UNITS FOR A PERIOD OF 10 YEARS. IN RETURN, THE US WILL PROVIDE 14 ADDITIONAL PATRIOT FIRE UNITS TO THE FRG THAT WILL BECOME FRG PROPERTY AT THE END OF THEIR INITIAL MANNING COMMITMENT. AGREEMENTS TO MAN THE GERMAN ROLAND FIRE UNITS AND THE PATRIOT FIRE UNITS ARE PROJECTED TO EXPIRE IN THE YEARS 1998 AND 2000 RESPECTIVELY, BASED ON CURRENTLY PROJECTED EQUIPMENT DELIVERY SCHEDULES. THE ACTUAL TEN-YEAR MANNING COMMITMENTS WILL BE CONSIDERED TO HAVE BEGUN ON THE DATE WHICH REPRESENTS THE

AVERAGE OF ALL DATES ON WHICH THE ELEMENTS OF THE PATRIOT BATTALIONS AND ROLAND FIRE UNITS HAVE COMPLETED COLLECTIVE TRAINING. BOTH NATIONS ARE REQUIRED TO INITIATE NEGOTIATIONS TO EXTEND THE AGREEMENT NO LATER THAN TWO YEARS PRIOR TO THE EXPIRATION DATE OF THE PATRIOT OR ROLAND MANNING, WHICHEVER OCCURS FIRST. INDICATIONS FROM BOTH PARTIES ARE THAT THE AGREEMENT WILL BE RENEGOTIATED AT THE APPROPRIATE TIME.

(U) ANOTHER SIGNIFICANT INTERNATIONAL PROGRAM IS AN AGREEMENT SIGNED BETWEEN THE UNITED STATES AND JAPAN IN OCTOBER 1985 FOR JAPAN TO ACQUIRE PATRIOT THROUGH LICENSED PRODUCTION OF ITS OWN FIRE UNITS. ADDITIONALLY, BELGIUM, KOREA, AND ITALY HAVE EXPRESSED INTEREST IN THE SYSTEM.

(U) THE $40.2 MILLION RDT&E REQUEST IS REQUIRED FOR THE CONTINUATION OF PATRIOT'S PRE-PLANNED PRODUCT IMPROVEMENT PROGRAMS TO ENHANCE SYSTEM PERFORMANCE AS THE THREAT CONTINUES TO EVOLVE. ADDITIONALLY, THOSE FUNDS ARE REQUIRED TO PROVIDE A DIRECT INTERFACE TO JTIDS EQUIPPED SYSTEMS. THE FY87 PROCUREMENT REQUEST OF $1.07 BILLION WILL BUY TWELVE FIRE UNITS INITIAL SPARES, AND 700 MISSILES.

ANTI-TACTICAL MISSILE (ATM)

(U) THE ANTI-TACTICAL MISSILE PROGRAM WAS INITIATED TO DEVELOP NEAR AND LONG TERM DEFENSES AGAINST THE SOVIET TACTICAL MISSILE THREAT. THE NEAR TERM DEFENSE MODIFIES PATRIOT AND HAWK MISSILE SYSTEMS. THE MODIFICATION GIVES THE TWO SYSTEMS A CAPABILITY TO DETECT AND ENGAGE INCOMING TACTICAL MISSILES, WHICH PROVIDES AN EARLY SELF PROTECTION CAPABILITY. THIS CAPABILITY ALSO PROVIDES COLLATERAL AREA PROTECTION TO UNITS OPERATING IN PROXIMITY OF HAWK AND PATRIOT SYSTEMS. THE NEAR TERM PLAN ALSO INCLUDES RESEARCH NEEDED TO DEVELOP A WEAPON SYSTEM CAPABLE OF DESTROYING TACTICAL MISSILE LAUNCHING EQUIPMENT. THE LONG TERM

DEFENSE PLAN CALLS FOR A JOINT SYSTEMS APPROACH TO DEVELOP A CONCEPT FOR COUNTERING THE TOTAL TACTICAL MISSILE THREAT. RESEARCH WILL BE CONDUCTED TO DETERMINE THE POSSIBLE USE OF ALL TECHNOLOGIES AND EXISTING SYSTEMS. THE RESEARCH WILL FOCUS ON PASSIVE AND ACTIVE COUNTERMEASURES AND THE DEVELOPMENT OF SENSOR TECHNOLOGY. THE NEED FOR A NEW WEAPON SYSTEM WILL BE ANALYZED AND EVALUATED. THE FINAL SOLUTION COULD REQUIRE A COMBINATION OF ARTILLERY WEAPONS SUCH AS NEW OR MODIFIED SENSORS, NEW OR IMPROVED WEAPONS TO ENGAGE TACTICAL MISSILES, INTEGRATED CONTROL SYSTEMS, AND THE ARMY TACTICAL MISSILE SYSTEM (ARMY TACMS).

(U) FY87 DEVELOPMENT FUNDS OF $38.6 MILLION ARE REQUIRED TO CONDUCT TESTING OF PATRIOT SYSTEM MODIFICATIONS AND TO CONTINUE ADVANCED DEVELOPMENT OF HAWK IMPROVEMENTS AND PATRIOT RADAR SOFTWARE. THESE FUNDS WILL ALSO BE USED FOR CONTINUED DEVELOPMENT OF COUNTER-LAUNCHER MUNITIONS.

COMBAT IDENTIFICATION SYSTEMS (CIS)

(U) THE FINAL PROGRAM AREA TO ADDRESS IS THE ARMY COMBAT IDENTIFICATION SYSTEM. THIS PROGRAM IS A STUDY AND PROCUREMENT EFFORT TO IMPROVE OUR AIR DEFENSE AND GROUND SYSTEM IDENTIFICATION CAPABILITIES. THE OVERALL PROGRAM CONSISTS OF A POSITIVE HOSTILE IDENTIFICATION COMPONENT (THE ARMY PORTION DISCUSSED PREVIOUSLY AS AN INTEGRAL PORTION OF THE FAAD $C^2I$ COMPONENT TO THE FAAD SYSTEM) AND A COOPERATIVE IFF COMPONENT.

(U) THE COMBAT IDENTIFICATION SYSTEMS PROGRAM IS A TRI-SERVICE PROGRAM TO PROVIDE POSITIVE HOSTILE IDENTIFICATION AND TO IDENTIFY FRIENDS. IDENTIFICATION OF HOSTILE AIRCRAFT IS A CRITICAL FACTOR IN PROTECTING OUR FRIENDLY AIRCRAFT AS WELL AS SUCCESSFULLY ENGAGING THE ENEMY EARLY. IDENTIFICATION-FRIEND-OR-FOE (IFF) EQUIPMENT IS CURRENTLY INSTALLED ON HIMAD AND FAAD WEAPONS AND SENSORS. THE MARK XII

IFF WE NOW HAVE IS A COOPERATIVE, QUESTION-AND-ANSWER SYSTEM THAT WILL DETERMINE IF AN AIRCRAFT IS A FRIEND -- PROVIDED THE AIRCRAFT IS EQUIPPED WITH A CORRECTLY KEYED TRANSPONDER AND TACTICAL PROCEDURES ALLOW THE PILOT TO TURN THE EQUIPMENT ON OVER THE BATTLEFIELD. THIS SYSTEM IS DESIGNED TO PROTECT FRIENDLIES AND REDUCE FRATRICIDE BUT CONTRIBUTES LITTLE TO THE IDENTIFICATION OF HOSTILE TARGETS THAT MUST BE ENGAGED. AS A RESULT OF THIS LIMITATION, NORMAL JOINT AND NATO PROCEDURES REQUIRE FAAD WEAPONS CREWS TO VISUALLY IDENTIFY TARGETS AS HOSTILE BEFORE THEY CAN BE ENGAGED THUS PREVENTING THESE WEAPONS FROM REALIZING THEIR OWN ENGAGEMENT POTENTIAL.

(U) MARK XII IFF EQUIPMENT WILL BE REPLACED BY A MARK XV SYSTEM THAT WILL BE DESIGNED TO IMPROVE THE OPERATIONAL AND ECCM CAPABILITIES, AVAILABILITY, AND THE SECURITY OF THE SYSTEM. THE SYSTEM WILL BE EMPLOYED ON PATRIOT, HAWK, AND FAAD SENSORS.

(U) OTHER COMBAT IDENTIFICATION SYSTEMS ARE BEING DEVELOPED TO SOLVE THE POSITIVE HOSTILE IDENTIFICATION PROBLEM. A VARIETY OF TECHNICAL CONCEPTS ARE BEING INVESTIGATED TO DETERMINE HOW POSITIVE HOSTILE TARGET AND INTELLIGENCE INFORMATION CAN BEST BE FURNISHED TO FAAD WEAPON SYSTEMS.

(U) THE BUDGET REQUEST OF $6.3 MILLION IS REQUIRED TO CONTINUE THE RESEARCH NECESSARY TO DEVELOP COOPERATIVE IFF SYSTEMS.

CHART 19

SUMMARY

(U) IN THE FORWARD AREA, THE EVOLVING AND PROJECTED THREAT CAPABILITIES CAN BE MET BY THE FAAD SYSTEM -- A FINITE SET OF INTERLOCKING PIECES DESIGNED TO ALLOW THE ENEMY NO PREFERRED LOW ALTITUDE ATTACK OPTION. THE CORPS AND EAC SYSTEMS PROVIDE HIGH-TO-MEDIUM COVERAGE OVER THE BATTLEFIELD NEEDED TO KILL AIRCRAFT FORCED UP FROM LOW ALTITUDES. ROBUST COMMAND AND

CONTROL SYSTEMS BEING UPGRADED OR IN DEVELOPMENT INCORPORATE TECHNOLOGICAL ADVANCES TO INTEGRATE OUR DIFFERENT ECHELONS OF AIR DEFENSE -- COMBINED ARMS, JOINT SERVICES AND OTHER NATIONS. CHART 26 THE ARMY'S AIR DEFENSE BUDGET FOR FY87 SUPPORTS A CRITICAL INTEGRATED PROGRAM IN DEFENSE OF OUR ARMED FORCES. THIS PROGRAM ALSO TRULY REPRESENTS THE TOTAL ARMY AS IT PROVIDES FOR SUBSTANTIAL IMPROVEMENTS FOR OUR NATIONAL GUARD FORCES.

(U) YOUR CONTINUED SUPPORT OF OUR AIR DEFENSE PROGRAMS DIMINISHES THE THREAT OF ARMED CONFLICT AND FURTHERS THE ABILITY OF OUR ARMY TO PRESERVE THE PEACE THROUGH THE TWENTY-FIRST CENTURY. I APPRECIATE THIS OPPORTUNITY TO SUBMIT THIS STATEMENT TO THE COMMITTEE.

## STATEMENT HIGHLIGHTS

- THREAT
- EMPLOYMENT CONCEPT
- WEAPONS PROGRAMS
  - ► DIVISION (FORWARD AREA AIR DEFENSE) SYSTEMS
  - ► CORPS SYSTEMS
  - ► ECHELONS ABOVE CORPS SYSTEMS
- SUMMARY

Chart 1

## POWERFUL TRENDS ALL AIR FORCES WILL FOLLOW

| | |
|---|---|
| ● STANDOFF MUNITIONS FROM LOW ALTITUDE HELICOPTERS AND FIXED WINGS | - BEYOND RANGE OF LINE-OF-SIGHT SYSTEMS<br>- FROM BEHIND MASK |
| ● SUPPRESSED PLUMES, AND INFRARED (IR) JAMMERS | - DEGRADE IR MISSILES |
| ● ANTI-RADIATION MISSILES | - ATTACK LOW DENSITY SURFACE TO AIR MISSILE (SAM) SYSTEM RADARS |
| ● LOW OBSERVABLE TECHNIQUES PLUS ELECTRONIC COUNTER-MEASURES | - REDUCE RANGE OF SAMS |
| ● UNMANNED AERIAL VEHICLES & DRONES | - RECONNAISSANCE<br>- DEPLETE SAMS |
| ● SURFACE-TO-SURFACE MISSILES | - ATTACK SAMS & TACTICAL MISSILE LAUNCH SITES |

Chart 2

## AIR THREAT TO THE FORWARD AREA

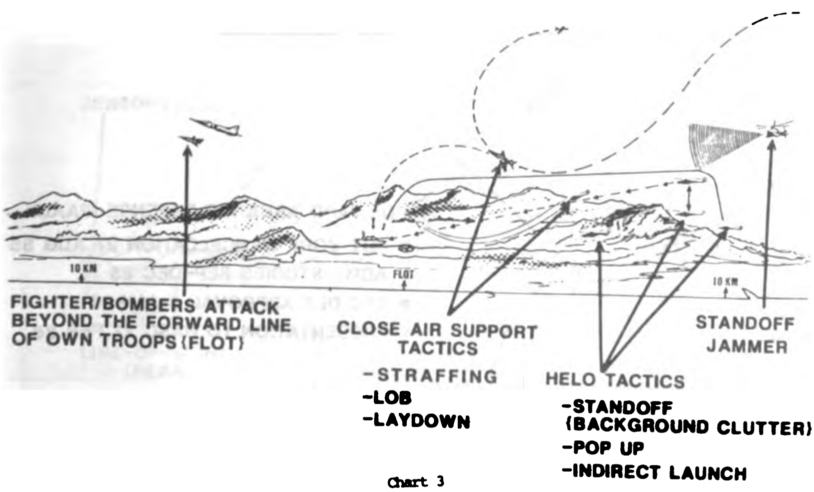



Chart 3

## COUNTER AIR CONCEPT

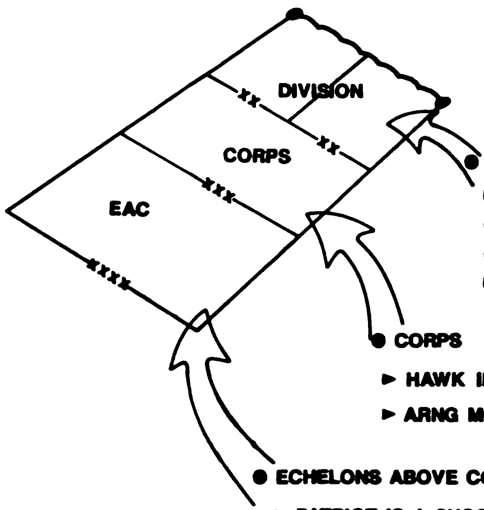
**TASKS**
- KILL THE THREAT
- REDUCE THREAT EFFECTIVENESS

**TRADITIONAL CONCEPT**
- REACTIVE
- DEFENSE ORIENTED
- WEAPONS MASSED AROUND CRITICAL ASSETS
- FINAL PROTECTIVE FIRE ORIENTATION
- SIMULTANEOUS ENGAGEMENTS OF SINGLE AIRCRAFT

**COMBINED ARMS CONCEPT**
- PROACTIVE
- ATTRITION ORIENTED
- DISPERSED BUT WEIGHTED WEAPON DEPLOYMENT
- ENGAGE THREAT BEYOND ORDNANCE RELEASE POINT
- SEQUENTIAL ENGAGEMENTS

Chart 4

## FY87 AIR DEFENSE ROADMAP




- FORWARD AREA AIR DEFENSE (FAAD)
  - ► SGT YORK CANCELLATION 27 AUG 85
  - ► ARMY STUDIES SEP-DEC 85
  - ► SEC DEF APPROVAL 8 JAN 86
  - ► PRESENTATION TO HASC 27 FEB 86
- CORPS
  - ► HAWK IMPROVEMENTS ARE ON TARGET
  - ► ARNG MODERNIZATION IN PROGRESS
- ECHELONS ABOVE CORPS
  - ► PATRIOT IS A SUCCESS STORY

Chart 5

## AIR DEFENSE OF THE BATTLEFIELD (DIVISION AREA)

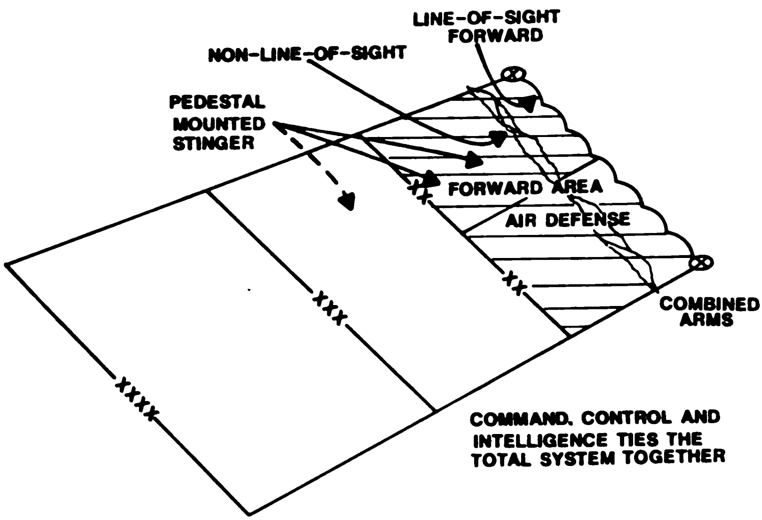
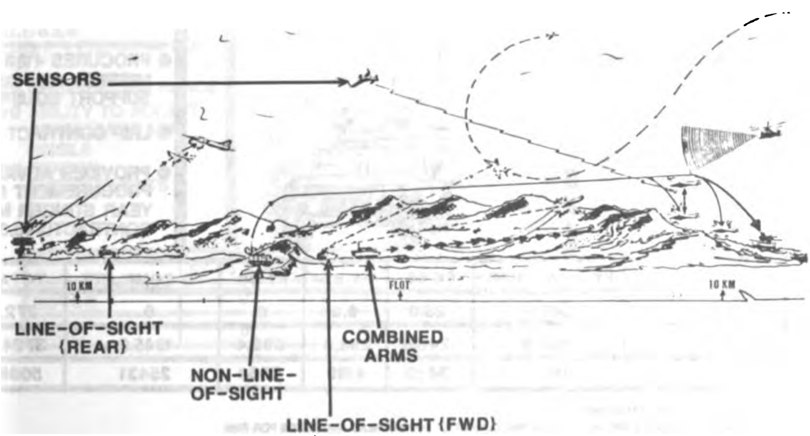



Chart 6

## FORWARD AREA AIR DEFENSE SYSTEM




COMMAND, CONTROL & INTELLIGENCE

Chart 7

## FORWARD AREA AIR DEFENSE COMMAND, CONTROL AND INTELLIGENCE

**FY 87 RDT&E REQUEST**
**$122.2M**

- AWARD CONTRACT FOR C[2] SYSTEM DESIGN AND SOFTWARE DEVELOPMENT
- CONDUCT LIVE SENSOR SHOOT OFF EVALUATION
- CONTINUE PASSIVE ID DEMON-STRATIONS AND BEGIN FULL SCALE DEVELOPMENT
- COMPLETE AERIAL SENSOR CONCEPT DEFINITION

**FY 87 PROC REQUEST**
**$0M**

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 99.1 | 55.9 [1] | 122.2 | 141.9 | 298.2 | 717.3 |
| PROC | | | | 0 | 1785.4 | 1785.4 |
| QTY (SYS) [2] | | | | 0 | 18 | 18 |

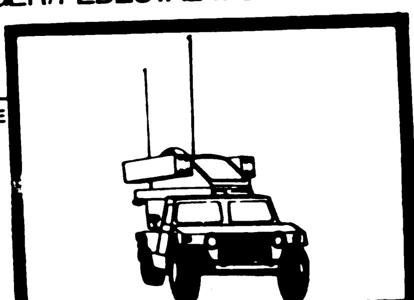
1. APPROPRIATED BUT NOT AUTHORIZED
2. DIVISION EQUIVALENT SETS

Chart 8

## STINGER/PEDESTAL MOUNTED STINGER

**FY 87 RDT&E REQUEST**
**$6.3M**

- COMPLETE REPROGRAMMABLE MICROPROCESSOR (RMP) DEVELOPMENT
- CONDUCT COMPETITIVE SOURCE SELECTION OF PMS



**FY 87 PROC REQUEST**
**$293.0M**

- PROCURES 4190 STINGER [illegible] MISSILES AND GROUND SUPPORT EQUIPMENT
- LRIP CONTRACT FOR PMS
- PROVIDES ADVANCED PROCUREMENT FOR MULTI-YEAR STINGER MISSILE CONTRACT([illegible])

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E [1] | 242.5 | 23.3 | 6.3 | 0 | 0 | 272.1 |
| PROC [2] | 923.5 | 246.6 | 293.0 | 396.4 | 1945.9 | 3794.5 |
| QTY (SYS) | 11650 | 3439 | 4190 | 5964 | 25431 | [illegible] |

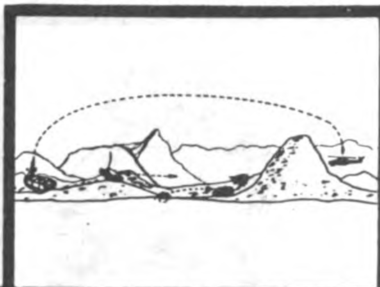
1. INCLUDES FUNDS FOR PMS
2. INCLUDES SPARES AND MULTI-YEAR PROCUREMENT FOR MISSILES AND FUNDS FOR PMS

Chart 9

## FORWARD AREA AIR DEFENSE
### NON-LINE-OF-SIGHT

**FY 87 RDT&E REQUEST $83.3M**

- EVALUATE ALTERNATIVES
- CONTINUE FOG-M DEVELOPMENT
- TEST FOG-M IN OPERATIONAL ENVIRONMENT



**FY 87 PROC REQUEST $0M**

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 0 | 19.7 [1] | 83.3 | 172.4 | 241.2 | 516.6 |
| PROC | 0 | 0 | 0 | 14.2 | 260.4 [2] | 274.6 |

1. APPROPRIATED BUT NOT AUTHORIZED
2. DOES NOT PROCURE THE TOTAL REQUIREMENT

Chart 10

## FORWARD AREA AIR DEFENSE
### LINE-OF-SIGHT FORWARD (LIGHT)
### (FORMERLY LADS)

**FY 87 RDT&E REQUEST $21.7M**

- BEGIN P³I PROGRAM FOR PMS
  - GREATER GUN RANGE
  - ABILITY TO ACCEPT COMPLEMENTARY MISSILE
  - SENSOR IMPROVEMENTS

**FY 87 PROC REQUEST $0M**

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 0 | 0 | 21.7 | 38.0 | 0 | 59.7 |
| PROC | 0 | 0 | 0 | 74.7 | 271.0 | 345.7 |

Chart 11

## FORWARD AREA AIR DEFENSE

### LINE-OF-SIGHT FORWARD (HEAVY)

**FY 87 RDT&E REQUEST $20.6M**

- COMPLETE ALTERNATIVE SYSTEMS EVALUATION
- SOURCE SELECTION
- AWARD PRODUCTION CONTRACT

**FY 87 PROC REQUEST $9.1M**

- LONG-LEAD ITEMS TO SUPPORT PRODUCTION OF HEAVY SYSTEMS

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 0 | 10.8 [1] | 20.6 | 16.6 | 0 | 48.0 |
| PROC | 0 | 0 | 9.1 | 65.4 | 1411.6 | 1486.1 |

1. APPROPRIATED BUT NOT AUTHORIZED

Chart 12

## AIR DEFENSE OF THE BATTLEFIELD

### (CORPS AREA)

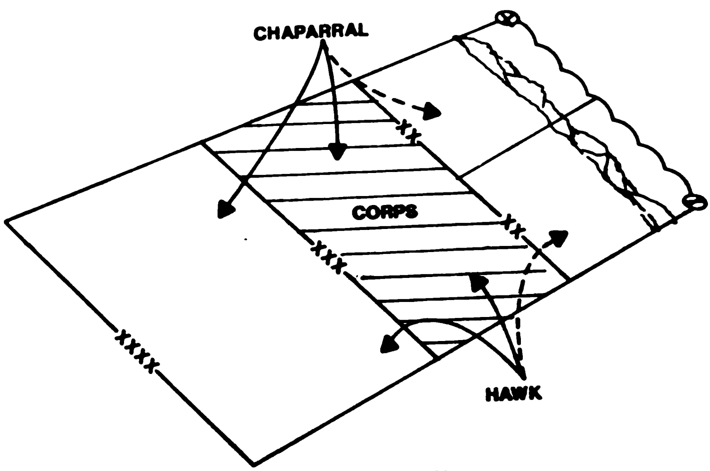
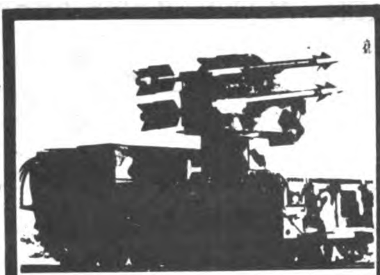



Chart 13

## CHAPARRAL

**FY 87 RDT&E REQUEST $5.6M**

- COMPLETE DEVELOPMENT OF ROSETTE SCAN SEEKER (RSS) MISSILES
- CONDUCT FLIGHT TESTS AGAINST ADVANCED INFRARED COUNTERMEASURE TARGET



**FY 87 PROC REQUEST $111.6M**

- PROCURES RSS MISSILE
- PROCURES FLIR NIGHT SIGHTS AND MINIMAL SMOKE ROCKET MOTORS
- WEAPON SYSTEM MODS

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 228.8 | 17.5 | 5.6 | 0 | 37.1 | 289.0 |
| PROC [1] | 545.1 | 169.2 [2] | 105.6 | 118.3 | 1250.4 | 2188.6 |
| MODS | 371.9 | 129.7 | 6.0 | 14.6 | 263.2 | 785.4 |
| QTY (MSL/FU) | 13320/544 | 0/40 [3] | 456/0 | 960/0 | 10474/0 | 25210/584 |

1. INCLUDES SPARES
2. $111.6M APPROPRIATED BUT NOT AUTHORIZED TO BE REPROGRAMMED FROM WTCV (FOLLOW-ON GUN)
3. NOT SHOWN ARE 24 FU'S FUNDED UNDER ARNG PROCUREMENT APPROPRIATION

Chart 14

## HAWK MODIFICATIONS

**FY 87 RDT&E REQUEST $10.6M**

- CONTINUE DEVELOPMENT OF FIELD MAINTENANCE EQUIPMENT (FME) PIP
- COMPLETE FUZE ARM DEVELOPMENT

**FY 87 PROC REQUEST $83.2M**

- BEGIN FUZE ARM PRODUCTION
- CONTINUE PHASE III MOD KITS/INITIAL SPARES PRODUCTION
- PROCURE 39 REPLACEMENT ROCKET MOTORS

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 324.1 | 5.1 | 10.6 | 15.9 | 149.7 | 505.4 |
| MODS [1] | 447.3 | 74.7 | 83.2 | 77.0 | 417.9 | 1100.1 |

1. INCLUDES ROCKET MOTOR REPLACEMENT REFLECTED IN OTHER MISSILE SUPPORT

Chart 15

## AIR DEFENSE OF THE BATTLEFIELD (ECHELONS ABOVE CORPS AREA)

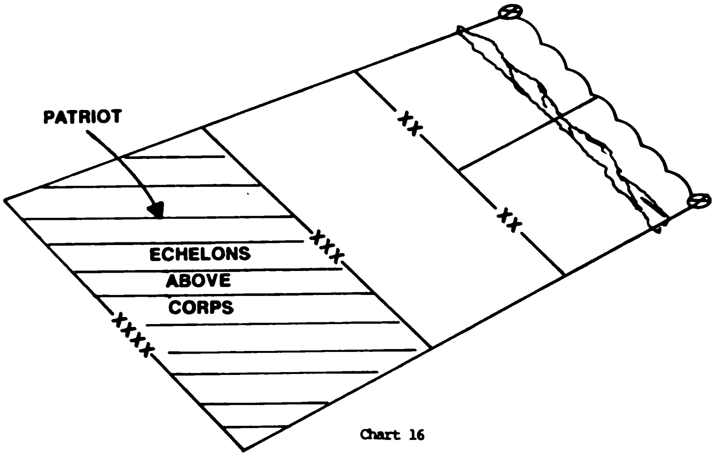
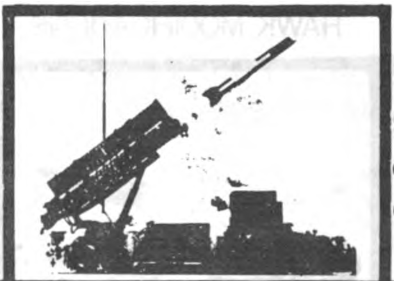



Chart 16

## PATRIOT

**FY 87**
**RDT&E REQUEST**
**$40.2M**

- ECCM ENHANCEMENTS
- RAM UPGRADE
- DIRECT JTIDS INTERFACE



**FY 87**
**PROC REQUEST**
**$1074.8M**

- PROCURES 12 FIRE UNITS AND 700 MISSILES
- FIRST YEAR OF FIVE YEAR MULTI-YEAR CONTRACT
- ADVANCED PROCUREMENT TO SUPPORT MULTI-YEAR CONTRACT

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E [1] | 2088.8 | 50.8 | 40.2 | 50.2 | 200.4 | 2430.4 |
| PROC [2] | 4566.3 | 1020.6 | 1033.9 [3] | 1038.6 [3] | 2202.3 [3] | 9861.7 |
| MODS [2] | 13.7 | 18.7 | 40.9 | 64.1 | 253.3 | 390.7 |
| QTY (MSL/FU) | 1590/55 | 585/12 | 700/12 | 715/12 | 2447/9 | 6037/100 |

1 REFLECTS CONVERSION FROM BASIC SYSTEM TO MODS RDT&E
2 INCLUDES SPARES
3 INCLUDES ADVANCED PROCUREMENT TO SUPPORT MULTI-YEAR CONTRACT

Chart 17

## PATRIOT INTERNATIONAL PROGRAMS

- NETHERLANDS - BUY 4 FIRE UNITS AND 160 MISSILES
- FEDERAL REPUBLIC OF GERMANY - COOPERATIVE AGREEMENT
  - FRG BUYS 60 ADDITIONAL ROLAND FIRE UNITS TO PROTECT FRG AIRBASE
  - PROVISION FOR TERMINATION AND FOLLOW-ON AGREEMENT

  - FRG BUYS 14 PATRIOT FIRE UNITS

  - US PROVIDES 14 PATRIOT FIRE UNITS WHICH BECOME FRG PROPERTY AFTER 10 YEARS

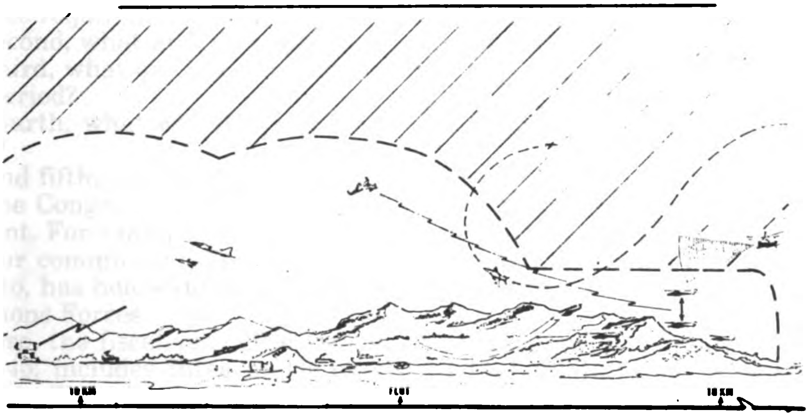
$ = $

- FRG PROCURES, MANS AND INTEGRATES 27 ROLAND FIRE UNITS INTO US AIR BASE DEFENSE SYSTEM FOR 10 YEARS
- FRG MANS, OPERATES AND MAINTAINS 12 US PATRIOT FIRE UNITS FOR 10 YEARS

- JAPAN-LICENSED PRODUCTION FOR 26 PATRIOT FIRE UNITS
- BELGUIM, ITALY AND KOREA HAVE EXPRESSED INTEREST

Chart 18

## AIR DEFENSE OF THE FORWARD AREA



--- FAAD COVERAGE

//// HIMAD COVERAGE

Chart 19

## AIR DEFENSE PROGRAM PROVIDES BIG PAYOFFS

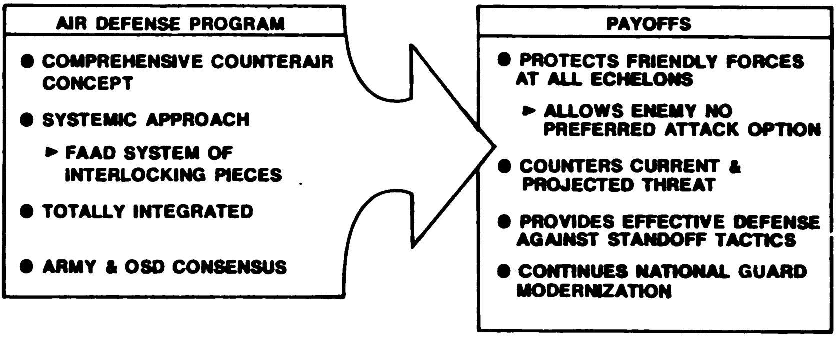



Chart 20

[Whereupon, at 3 p.m., the subcommittee was adjourned until 1 p.m., Monday, March 3, 1986.]

# DEPARTMENT OF DEFENSE SPECIAL OPERATIONS FORCES

House of Representatives,
Committee on Armed Services,
Procurement and Military
Nuclear Systems Subcommittee,
*Washington, DC, Monday, March 3, 1986.*

The subcommittee met, pursuant to notice, at 1 p.m., in room 2212, Rayburn House Office Building, Hon. Samuel S. Stratton (chairman of the subcommittee) presiding.

## STATEMENT OF HON. SAMUEL S. STRATTON, A REPRESENTATIVE FROM NEW YORK, CHAIRMAN, PROCUREMENT AND MILITARY NUCLEAR SYSTEMS SUBCOMMITTEE

Mr. Stratton. The subcommittee will come to order.

This afternoon the subcommittee will review the procurement requests for our Special Operations Forces. The review involves a number of issues and questions that need to be answered.

First, who is in charge of coordinating and consolidating the resource requirements of our Special Forces?

Second, what are the requirements for this procurement?

Third, what are the procurement details for the fiscal year 1987–91 period?

Fourth, what will this procurement buy us in terms of capabilities?

And fifth, how will these capabilities be used?

The Congress has already begun to focus on these areas to some extent. For example, the Special Forces Panel under the leadership of our committee colleagues, Representatives Dan Daniel and Earl Hutto, has held extensive hearings on the status of our Special Operations Forces.

Also, the fiscal year 1986 Defense Authorization Act, Public Law 99–145, includes three major provisions that relate to our Special Forces. We will want to learn what progress has been made in complying with provisions.

Specifically, section 144 is concerned with the readiness level of the Air Force HH-53 helicopter fleet.

Section 152 requires the development of plans to meet the airlift requirements of the Joint Special Operations Command.

Section 1453 expresses congressional support for the revitalization of the Special Operations Forces.

To assist us in obtaining the necessary information is Hon. Donald Latham, Assistant Secretary of Defense for Command, Con-

trol, Communications and Intelligence. He is joined by representatives of the military services.

Mr. Latham, can you get us started here?

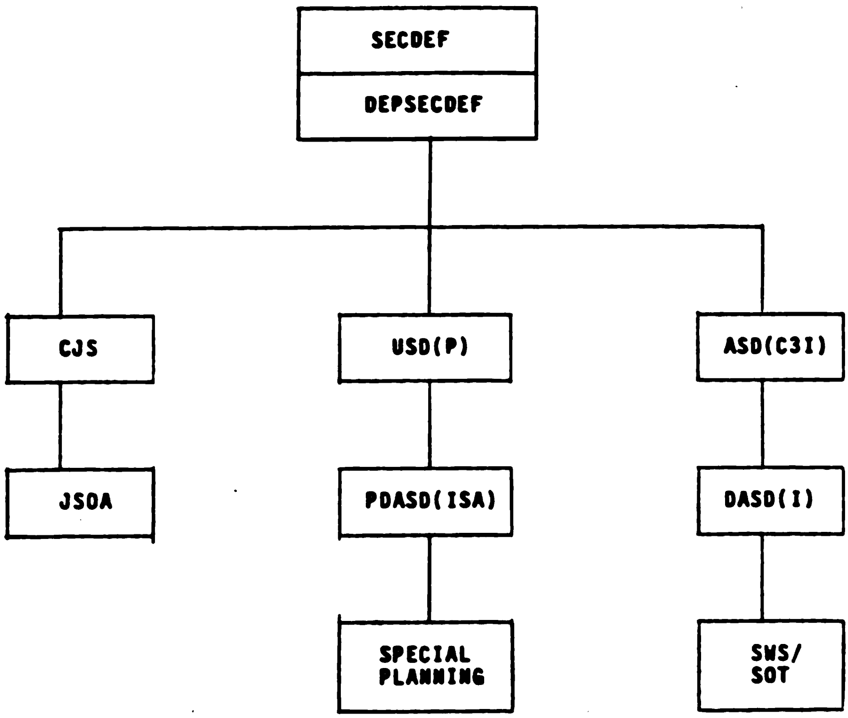
**STATEMENT OF HON. DONALD C. LATHAM, ASSISTANT SECRETARY OF DEFENSE FOR COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE, ACCOMPANIED BY CAPT. TED GRABOWSKY, HEAD, SPECIAL WARFARE BRANCH, OFFICE OF THE CHIEF OF OPERATIONS, DEPARTMENT OF THE NAVY; AND MAJ. GEN. J. MICHAEL LOH, DIRECTOR OF OPERATIONAL REQUIREMENTS, OFFICE OF THE DEPUTY CHIEF OF STAFF FOR RESEARCH, DEVELOPMENT AND ACQUISITION, DEPARTMENT OF THE AIR FORCE**

Mr. LATHAM. Yes, sir; I have a statement for the record. I would like to, as usual, show you some Vu-Graphs on summarizing this area.

One of the questions you asked us is sort of an organization issue. I thought I would try to address that first.

CHART 1

SKETCH OF SOF ORGANIZATION STRUCTURE




This is the Office of the Secretary of Defense. We are organized, as shown here, in terms of the oversight of the Special Forces situation. In particular, policy is developed in the Office of the Under Secretary of Defense for Policy.

One of my subordinate directorates is responsible for the fiscal oversight of the Special Operations Forces in counterterrorism and counterinsurgency areas, R&D, and procurement.

Under the Chairman of the Joint Chiefs of Staff, the Joint Special Operations Agency is headed by the Chairman or General Rice reports directly to him for advice, plans, and requirement analysis in the Joint Staff area.

CHART 2—SOF MISSIONS

Foreign internal defense, direct action, unconventional warfare, psychological operations, civil affairs, strategic reconnaissance, counter-terrorism.

The SOF missions that they are to undertake are summarized in chart 2. I think you are quite familiar with most of these. There has been a lot of emphasis of cost on the counterterrorism side of things and some on unconventional warfare, and all these are areas in which the Special Forces are trained and equipped to operate.

We have issued the Defense Guidance on the Special Operations Forces for fiscal year 1988 out to the 1982 timeframe. In that Defense Guidance we addressed the items noted here in chart 3, everything from policy through resources and specifications are there. I will show you what some of the specifications are in the Defense Guidance.

CHART 3—DEFENSE GUIDANCE ON SOF FOR FY 88 AND BEYOND

Policy.
Strategy.
Force planning.
1. Long term goals.
2. Mid-term (within 5 year plan-FYDP) objectives.
Resource planning.
1. Long term goals.
2. Mid-term objectives.
Fiscal.

For example, for fiscal year 1988 to fiscal year 1992 they have been directed to procure the items noted here [deleted], which are some additional [deleted] aircraft.

Mr. STRATTON. I think what we need to do is instead of a chart like this, which isn't going to mean very much to us, and which we could read without having the slide, we ought to get a little information about what these organizations are supposed to be doing.

Mr. LATHAM. Right.

Mr. STRATTON. And we are not on the committee that has that purpose and assignment but I think we need, I know that we have got the Navy Seals.

Mr. LATHAM. We are going into all of that.

Mr. STRATTON. We have got the people in Germany. I don't know what other units you have got, but I think we need to get a little background on this before we can determine whether you are in need of equipment and exactly what equipment, and to what extent Gramm-Rudman environment——

Mr. LATHAM. OK. We are prepared to do that. I was going to give a couple more Vu-Graphs to summarize the money and then let the services speak on exactly what——

Mr. STRATTON. My eyes begin to glass over when I see these Vu-Graphs. They are not very sexy.

Mr. LATHAM. Al right, let me hit you with some more unsexy Vu-Graphs. You asked about equipment, and what we are doing. This summarizes the key items that are in the modernization program—what we had in number since fiscal year 1980, what is being procured in fiscal year 1986 and prior. Then as you look out to the end of the FYDP, these are the numbers.

You will notice we are going from [deleted]. So there will be a very substantial increase in the amount of hardware that will be deployed with these forces over the next 5 years.

Mr. STRATTON. Does that chart indicate what your shortfall is, will this take you over the next 5 years?

Mr. LATHAM. Sir, this is the currently approved set of numbers that are in terms of where we are going. They are in the congressional justification books that we submitted to you for these specific items, for the forces. So these are the fiscally constrained numbers.

There is a planning force which is fiscally constrained that would be larger than this if we had all of the money that we could ask for. This is the money that is in the current President's budget out through the end of 1991. If you look at the dollars involved here, we go up from [deleted] total spent in this area in 1981, to the 1987 President's request of [deleted] in the dollars being allocated to this particular mission area by the services.

If you look at the——

Mr. SCRIVNER. Could you tell us what the outyears look like from 1987 with those numbers through 1991?

Mr. LATHAM. Yes, sir; they are roughly going to be increasing at a rate of—if you will notice here—[deleted] increase. I would say we are going to increase in this area something on the order of [deleted] a year we put extremely high priority on this. In fact, in the Gramm-Rudman initiative in, 1986 we [deleted].

Mr. SCRIVNER. This is more than procurement, right?

Mr. LATHAM. This is more than procurement. I will break it out for you. Procurement in 1987 is about [deleted]. By component I have broken it out here. The Air Force and the Army are about equal in size, about [deleted] and Navy and Marine Corps about [deleted] in the 1987 breakout. We are [deleted] in each of those.

I can show you now how this breaks out. The procurement number you are interested in today is primarily [deleted] for aircraft, around [deleted] other types of procurement in this total of [deleted] R&D, MILPAY, and so on are as shown.

If you look at it by services, the dollars are primarily in the Air Force for procurement [deleted] for aircraft, combat [deleted] primarily.

That summarizes the unsexy Vu-Graphs. Now we will get down to the details with the services.

Mr. STRATTON. We would like to know what we are funding and what they are going to be doing.

Mr. LATHAM. We will tell you.

## PREPARED STATEMENT OF HON. DONALD C. LATHAM

### OVERVIEW OF SPECIAL OPERATIONS

*A. Introduction*

The Joint Chiefs of Staff (JCS) define Special Operations as those conducted by specially trained, equipped, and organized Department of Defense forces against strategic or tactical targets in pursuit of national military, political, economic, or psychological objectives. The operations may be conducted during periods of peace or hostilities. They may support conventional military operations, or they may be prosecuted independently when the use of conventional forces is inappropriate.

Special Operations Forces (SOF) must be sized, structured, equipped, trained, and supported to meet national and theater requirements in peace, crisis, and war. The dedicated Special Operations Forces include the Army Special Forces, Army Psychological Operations units, Army Civil Affairs units, Naval Special Warfare Units (SEALS), Air Force Special Operations Forces, Army Rangers and Army Special Op-

## PREPARED STATEMENT OF MAJ. GEN. JERRY BUNYARD

Thank you for the opportunity to present to the SOF Panel of the Procurement Subcommittee of the HASC a report on the accomplishments achieved by the Army under our SOF Master Plan.

The Army has formed in recent years a modern, Total Force, balanced in terms of light and heavy combat formations, with a capability which is rapidly deployable and highly effective anywhere in the world. Regionally oriented Special Operations Forces are an important and intergral part of this Total Force. SOF must be considered an essential element of the total force that adds to our capabilities and effectiveness by providing increased flexibility and freedom of action to the National Command Authority.

In order to make as complete as possible a presentation in the time alloted, I have chosen to use a series of charts to guide my remarks. These charts are nearly self-explanatory and can also serve as Army's submission for the record, if you concur.

Before proceeding I would like to stress that Army SOF revitalization began before the impetus of the DepSecDef (Thayer) memo of Oct 1983. After Iran it became clear that Army SOF needed considerable revitalization to meet our counterterrorism and Low Intensity Conflict responsibilities. Initiatives implemented at that time included the establishment of 1st SOCOM and the Special Warfare Center and the completion of a very comprehensive Mission Area Analysis (MAA). Completed in May 1983, the MAA identified SOF missions, tasks and force deficiencies and recommended doctrine, organization, training and materiel corrections, which have continued to guide improvements to Army SOF.

### CHART 1—ARMY SOF MASTER PLAN

Services tasked by DEP SECDEF to prepare master plans for SOF enhancements.

Army master plan approved by SECARMY 4 April 1984.

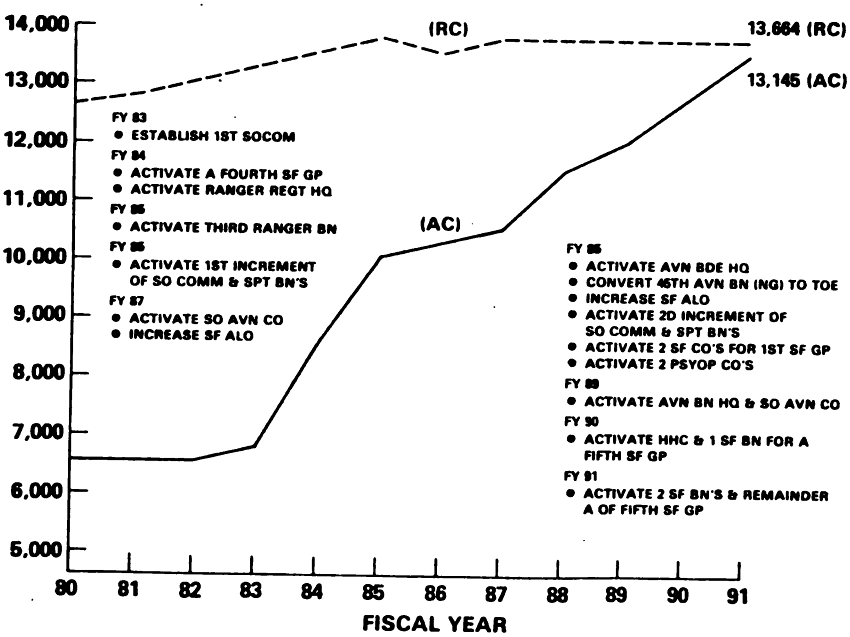
Master plan is architecture for significant SOF improvements in: force structure and basing; readiness; command and control; management; resourcing.

As the first chart indicates, the Army's Master Plan codifies the architecture for improving SOF in the basic functional areas of: Force structure and basing; readiness; Command and Control; Management Resourcing.

These areas of emphasis are consistent with the Thayer memo of Oct 83 and current Defense Guidance.

CHART 2

# FORCE STRUCTURE IMPROVEMENTS




As chart 2 shows, Army force structure improvements—accomplished and planned—are significant. Already activated is a fourth SF Group, the third Ranger Bn and the Regimental Headquarters. Note the actual ACTIVE COMPONENT (AC) strength increases which have occurred since 1983.

Fiscal year 1986 and beyond activations are already in the Army's approved force structure program (TAA process). You should also note the Authorized Level of Organization (ALO) which will bring AC SOF to full wartime required strength by fiscal year 1988.

A new SF Group will be activated in fiscal year 1990 and 1991. This will be the fifth AC group and will be [deleted].

SOF aviation activations are in consonance with the DepSecDef's guidance of 22 Aug on the Army/AF initiative No. 17. This will add one company each of MH60's and MH47's to 1st SOCOM's Aviation Bde by fiscal year 1991. I will talk more on aviation later in my presentation.

The next two charts show the Active and Reserve Component (AC and RC) SOF basing—RC units are more dispersed than represented by the headquarters locations which are depicted on the chart. Throughout the US there are 98 SOF RC units of all types.

CHART 3

## SOF BASING (AC)

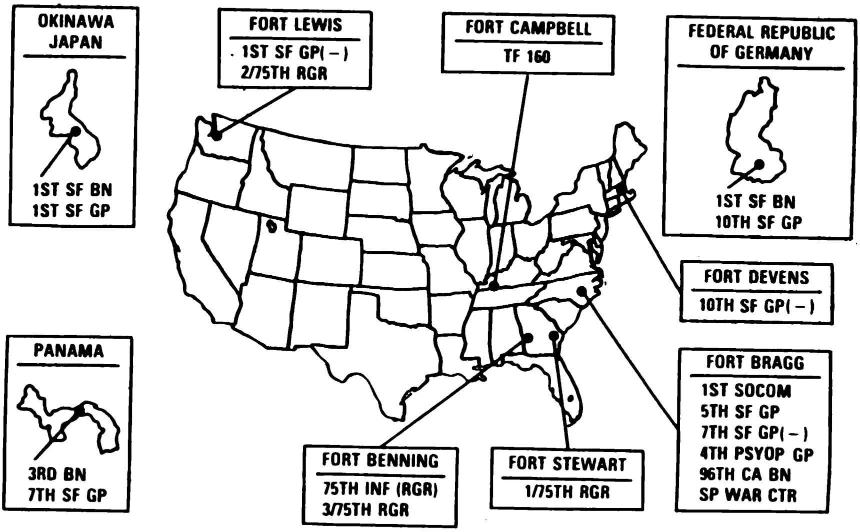
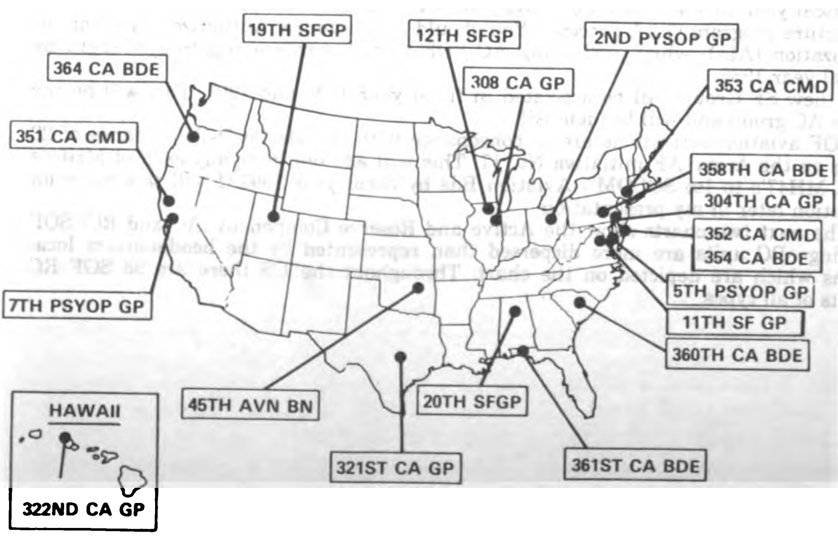



CHART 4

## SOF BASING (RC)



(CHART 5) (SOF FORCE ALLOCATION) [DELETED]

This next chart lays out the wartime OPLAN allocation of SOF. This allocation follows JSCP (Joint Strategic Capabilities Plan) Guidance.

(CHART 6) (READINESS IMPROVEMENTS) [DELETED]

Readiness improvements are highlighted on the next chart (Chart 6). Starting on the left of the chart, the total number of active and reserve battalions is depicted according to SOF functional area. The graph on the right highlights the improving trend in achieving combat readiness since April 1985. [Deleted.]

The next chart (Chart 7) shows recent readiness improvement actions taken by the Army. This includes project SOF, an intensive management effort designed to increase equipment on hand in all active SOF units. This coal has been achieved.

CHART 7—READINESS ACTIONS

Project SOF—established. Fixes equipment on hand problems.

SOF readiness action group—formed: Standing Army Committee; Manages SOF readiness.

DAMPL—increased. SOF now FAD II (ahead of 82d airborne).

Language Program—revised. Establishes near term enhancement; provides for expansion and sustainment.

Army development and evaluation agency—adds SOF.

A SOF readiness action group was formed in April 1985 to address personnel, equipment and training. This standing committee manages SOF readiness in detail and consists of members from across the Army Staff and major subordinate units.

In the area of language improvements, the Army has revised its program for near term enhancement by increasing the numbers of students at both the Defense Language Institute and the Army Command Language School. The long term language program will continue to expand in the numbers of language trained SOF personnel, while simultaneously focusing on sustainment of skill capability.

Another initiative is the inclusion of SOF issues in the Force Modernization charter of the Army Development and Evaluation Agency (Ft. Lewis). That agency is chartered to evaluate available technology to rapidly improve Army capabilities.

The next chart (Chart 8) lists some of the actions designed to enhance Command and Control of the Army SOF. As previously mentioned, the establishment of 1st SOCOM as a headquarters responsible for worldwide Command and Control of Army SOF has improved readiness and sustainability of the Special Operations Forces.

CHART 8—COMMAND AND CONTROL

Improvements: 1st CONCOM established October 1982 to command all Active Army SOF; Capstone aligns Reserve component SOF with Wartime Mission & Controlling Headquarters; Headquarters Ranger Regiment established July 1984 to command the three Ranger battalions; TF 160 Command transferred from 101st Airborne Division to 1st SOCOM in Feb 1985.

Through Capstoning, reserve component SOF units are able to effectively orient their efforts to their wartime mission and make maximum use of available training time and resources. Activation of the Ranger Regiment gives us an Enhanced capability for Command and Control of this valuable, but limited, asset, while at the same time standardizing Ranger training and overall mission readiness. The transfer of TF 160 to SOCOM serves to more effectively centralize command and control.

CHART 9—SOF MANAGEMENT SYSTEM

Director of operations has Army coordination responsibility.

SOF managed functionally by DA.

General Officer Steering Committee facilitates SOF management.

Policy, Procedural, Requirements & Doctrine Guidance established by: SOF Master Plan (DA); SO Mission Area Analysis/Mission Area Development Plan (TRADOC); SOF System Program Review (TRADOC); SOF Modernization Action Program (DA); Functional Area Assessment (DA for VCSA).

1st SOCOM commands Active Army SOF & monitors War Plan requirements, training & readiness for Reserves.

Special Warfare Center develops SOF concepts & doctrine conducts individual qualification training, performs combat/materiel development for SOF.

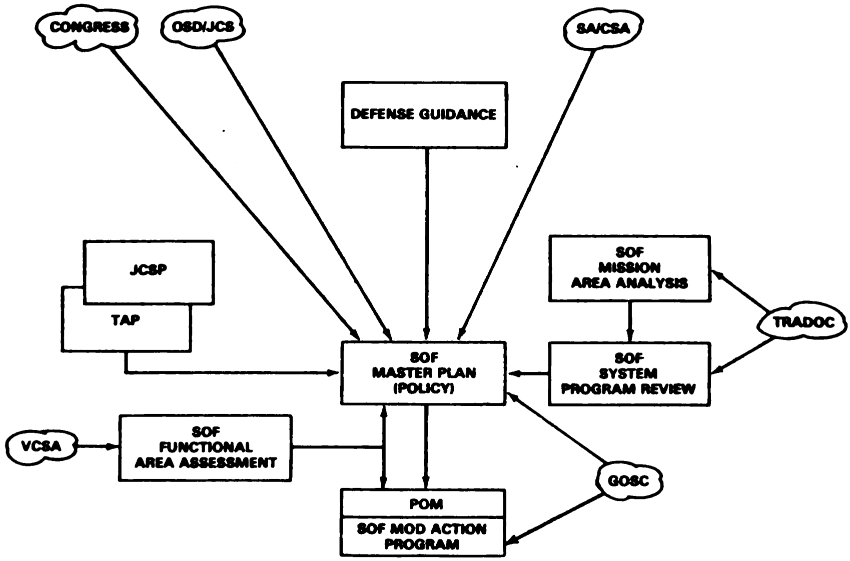
Army Materiel Command as materiel developer for Army, sustains current systems and procures new systems.

Chart 9 depicts those initiatives which the Army has taken to improve the management of SOF. Department of the Army has retained overall management responsibility for Special Operations Forces Policy, requirements and enhancement effort. At DA, the Director of Operations exercises this oversight responsibility through a General Officer's Steering Committee which meets quarterly and represents Major Army Commands worldwide.

The five plans and programs shown here establish SOF policy, and provide for the overall direction and modernization of SOF.

Ist SOCOM, which was created in October 1982, commands the active component SOF and monitors readiness activities in reserve component SOF units. The Special Warfare Center at Fort Bragg and Army Materiel Command, respectively, perform their function as SOF proponent and materiel developer for SOF equipment.

Chart 10




This chart depicts the flow of guidance from Defense, Congress, OSD/JCS, and SA/CSA into the SOF Master Plan. Also shown are the various inputs into the Master Plan. These inputs are incorporated into a SOF policy document that describes the SOF architecture required to meet Defense and other guidance. The SOF Modernization Action Program (SOFMAP) translates the Master Plan into SOF programs. The HQDA SOF Functional Area Assessment, which is chaired by the Vice Chief of Staff, is the forum for assessing progress towards achieving HQDA approved SOF enhancements.

The General Officer Steering Committee provides the necessary oversight to ensure the SOF Modernization Action Program is carried out in a timely and effective manner.

There are two specific areas of interest of materiel acquisition that I have been asked to address. They are SOF Communications and SOF Aviation.

(CHART 11) (SPECIAL OPERATIONS COMMUNICATIONS BATTALIONS) [DELETED]

The SOF communication Battalion will [deleted]. It provides the required [deleted]. This capability will be available starting in [deleted] with a full capability by [deleted]. Capabilities of this unit are as shown on the chart.

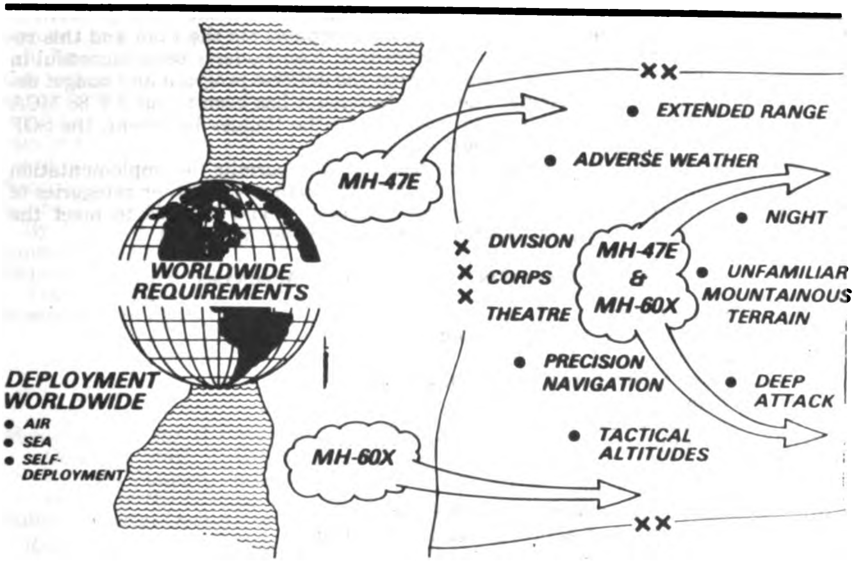
(CHART 12) (SPECIAL FORCES BURST COMMUNICATIONS SYSTEM) [DELETED]

The SOF burst communications system consists of HF radios and UHF satellite radio systems which will provide the link, between the base stations and the operational teams. Our Fiscal Year 1987 request is for $42,65M and the out years programming will provide the required support. The Major Communications Equipment Procurements that will be [deleted] are shown on the chart.

Chart 13

# AVIATION SYSTEMS

## SPECIAL OPERATIONS FORCES (SOF) AVIATION




Army SOF aviation includes responsibility for a broad spectrum of worldwide missions. Therefore, SOF aircraft must be capable of rapid deployment by any feasible means—Air, Sea, or Self-Deployment. Employment can occur anywhere on the battlefield, but will principally be concentrated in areas beyond the forward line of friendly troops, and in the harshest combat environments.

The Army intends to provide this nation with a most credible SOF Aviation Force, capable of extended range, night, low level penetration over unfamiliar mountainous terrain, and in all weather conditions.

(CHART 14) (ORGANIZATION CHART) [DELETED]

The Army currently has organized the 1st Special Operations Command at Fort Bragg, North Carolina. SOCOM is responsible for organizing and training SOF Forces, to include Aviation. The Army has one SOF Aviation Battalion in the Active Force today, shown as TF 160 on the chart, and there is an additional unit in the Reserve Component which is not depicted. Important elements that do not currently exist in this command are a SOF Aviation Brigade Headquarters, and a SOF Aviation Battalion dedicated to support Special Operations Forces. Our objective is to field a highly capable aviation battalion for this purposes by fiscal year 1991. [Deleted]. This Aviation Force will be fielded over a reasonable period of time in order to allow for proper development, thorough training and adequate support.

Development and procurement of both All-Weather Aircraft, the MH-60X and the MH-47E, is planned to be a single competitive contract for integration of a common integrated cockpit, which is a Computerized Mission Management System.

The Army is exploring the feasibility of a joint Army-Air Force program for acquisition of the MH-60X/HH-60A. The Army is also exploring the feasibility and legality (in light of requirements of the Competition and Contracting Act) of using developments from the HH-60A program to the extent possible.

We have charted a course of action and desire to move out smartly toward achieving the objective of properly outfitting our SOF Aviation Force. The Army has a good plan to enhance SOF Aviation Rotary Wing Capabilities. I believe our plan is Effective, Achievable, and Affordable. In the near term, by modifying aircraft that are common airframes to the rest of our Conventional Aircraft Fleet, we will provide a capable force while achieving many economies in areas of logistics and training, and we will also proclude unnecessary expenses. Our further requirements are being studied.

(CHART 15) (RESOURCE (TOA $) IMPROVEMENTS) [DELETED]

My last chart presents the Army's resource accomplishments and projections which actualize our Master Plan. The "Program" implements the Plan and this resource profile is obviously and significantly positive. Also we have been successful in protecting our SOF enhancement program from the defense program and budget decrements apportioned to the Army. The only decrement has been to our FY 88 MCA program. This caused some slippage in facilities for the Ranger Regiment, the SOF Aviation Brigade and the fifth SF Group.

This resource trend, if not further disturbed, not only permits the implementation of our Master Plan, but also sustainment of SOF in balance with other categories of Army Forces. Army SOF enhanced by our program should be able to meet the CINC's wartime and contingency requirements at any level of conflict.

SPECIAL OPERATION FORCES RELATED ACRONYMS

AC—Active Component.
ALO—Authorized Level of Organization.
AVN—Aviation.
$C^3$—Command, Control, and Communications.
CA—Civil Affairs.
CINC—Commander in Chief.
COMM—Communications.
CSA—Chief Staff of Army.
DA—Department of Army.
DEP SECDEF—Deputy Secretary of Defense.
DAMPL—Department of Army Master Priority List.
FAD—Force Activity Designator.
GOSC—General Officer Steering Committee.
GP—Group.
JCS—Joint Chiefs Staff.
JSCP—Joint Strategic Capability Plan.
LNO—Liaison Officer.
MAA—Mission Area Analysis.
MOD—Modernization.
OSD—Office Secretary Defense.
POM—Program Objective Memorandum.
PSYOP—Psychological Operations.
RC—Reserve Component.
REGT—Regiment.
RGR—Ranger.
SA—Secretary Army.
SF—Special Forces.
SOCOM—Special Operations Command.
SOF—Special Operation Forces.
SP WAR CTR—Special Warfare Center.
TAP—The Army Plan.
TF—Task Force.
TOA—Total Obligation Authority.
VCSA—Vice Chief Staff Army.

APPENDIX A

OCTOBER 3, 1983.

Memorandum for the Secretaries of the Military Departments, Chairman of the Joint Chiefs of Staff, under Secretaries of Defense, Assistant Secretaries of Defense, Director [Program Analysis and Evaluation], Assistants to the Secretary of Defense, Directors of the Defense agencies.

Subject: Special Operations Forces.

U.S. national security requires the maintenance of Special Operations Forces (SOF) capable of conducting the full range of special operations on a worldwide basis, and the revitalization of those forces must be pursued as a matter of national urgency. Therefore, I am directing that the following steps be taken:

1. Necessary force structure expansion and enhancements in command and control, personnel policy, training, and equipment will be implemented as rapidly as possible and will be fully implemented not later than the end of Fiscal Year 1990.
2. Collateral activities will be enhanced as necessary to provide fully effective support to the planning and execution of special operations.
3. Each Service will assign SOF and related activities sufficient resource allocation priority and will establish appropriate intensive management mechanisms to ensure that these objectives are met.
4. Resource decisions for current and programmed SOF, once made at the Secretary of Defense level, will not be changed or reduced by OSD or Service staffs unless coordinated by the Principal Deputy Assistant Secretary of Defense (International Security Affairs) and the Assistant Secretary of Defense (Comptroller) and approved by the Secretary of Defense.

By 1 March 1984 each Military Department and Defense Agency will submit a time-phased master plan for achieving these objectives for review by the Principal Deputy Assistant Secretary of Defense (International Security Affairs).

You should disseminate this memo as widely as possible within your organization to ensure that the priority attached to this program is clearly understood.

PAUL THAYER,
*Deputy Secretary of Defense.*

JANUARY 31, 1986.

Memorandum for the Secretaries of the Military Departments; Chairman, Joint Chiefs of Staff; Under Secretaries of Defense; Assistant Secretaries of Defense; General Counsel; Inspector General; Assistants to the Secretary of Defense; Directors of the Defense agencies.

Subject: Special Operations Forces Master Plans.

Revitalization and maintenance of Special Operations Forces (SOF) capable of conducting the full range of special operations in peacetime and at all levels of conflict on a global basis is essential to our national security.

Reflecting the importance of SOF, the Department of Defense, in 1983, established as its goal the completion of the revitalization process by the end of fiscal year 1990. I reaffirm that goal and direct the Services and Defense Agencies to give this effort the priority necessary to *ensure* its successful completion.

We must also ensure that our special operations capability evolves in a balanced, joint manner. To accomplish this, each Service and Defense Agency will submit, by 31 March 1986, an interim report detailing the steps it will take to meet Department of Defense objectives in the current FYDP. The final updated SOF Master Plans will be submitted by 31 July 1986. In consultation with the Director, Special Planning, OASD(ISA), the Director of the Joint Staff will develop a standard format for preparation of these plans and conduct an independent assessment of the plans upon submission.

CASPAR W. WEINBERGER.

## PREPARED STATEMENT OF MAJ. GEN. J. MICHAEL LOH

Mr. Chairman and members of the committee: I am Major General Mike Loh, the Air Force's Director of Operational Requirements in the Deputy Chief of Staff, Research, Development and Acquisition. I am pleased to appear before this committee to answer your questions on the Air Force's vitally important special operations programs. I will give you a progress report on our equipment modernization efforts in the SOF mission area, both for new aircraft development and procurement, and the modification of existing aircraft.

My responsibilities include finding technical and equipment solutions to operational deficiencies as we project our SOF forces into the late 1980's and beyond. What we find as we look at the threat to our medium and long range infiltration, exfiltration and resupply missions is the need to equip our SOF forces with new and modified aircraft capable of dealing effectively in an increasingly hostile environment. We must increase our capability to provide concealment by underflying radars and air defenses in day, night, through and under the weather; allow for terrain masking at very low altitudes to avoid detection; and operate from short, and in some cases unprepared strips; and do all of this with higher payloads, at longer ranges—reliably and safely. We must also equip our gunship force with replacement aircraft and systems to ensure their effectiveness well into the future.

We are committed now more than ever to this modernization effort, and I want to cover briefly our major acquisition programs which will allow us to do this.

Our most mature program is the MC-130H Combat Talon II. As you have already seen in our FY 87 budget request, we have restructured and accelerated this program. We have reviewed our acquisition strategy and Secretary Rourke has reported on this review and restructuring to Congressman Aspin and also Senator Goldwater. We have five aircraft on contract, and are requesting FY 86 reprogramming to allow the purchase of two more. We will increase our production rate to five aircraft a year in FYs 1987 and 1988. With the accelerated program, full operational capability with 21 Combat Talon II aircraft will be reached at the end of FY 90.

To complement the MC-130 in accomplishing deep infiltration and exfiltration missions, we're heavily involved with the Navy in development of the CV-22. This airplane with its vertical and short field takeoff and landing capabilities will significantly reduce the shortfall in special operations airlift, especially in long range exfiltration.

The CV-22 is our solution to the long term SOF airlift requirement, but we aren't neglecting the near term long range helicopter shortfall. We are currently modifying two H-53 helicopters to the PAVE LOW III configuration to replace the two lost in accidents. In addition to this, and at your direction, we have begun to modify 10 more H-53s to a PAVE LOW Enhanced configuration. This will give us a total of 19 PAVE LOW IIIs.

The three programs I've just described alleviate our shortfall in SOF airlift. A recent Air Force review of our SOF readiness status has highlighted the requirement to fix our AC-13 O gunships. Our plan is to procure 12 new gunships and retire the aging AC-13 OA gunships in the Reserve. A Request for Information has gone to industry to help us define the equipment suite for the new gunships. This program is an FY 87 new start and we've already begun preparation of the RFP with the intent of awarding a contract in early FY 87.

These four programs are the foundation of our SOF revitalization efforts but they are not the total effort. We are also upgrading the existing fleet with a number of system improvements. These include an ongoing $275M program to upgrade our MC-13 OE Combat Talon I and AC-13 OH gunships with new mission and fire control computers, Electronic Counter Measures, Inertial Navigation Systems and data burst and satellite communications. In addition to the PAVE LOW mods I've already mentioned, we have ongoing programs to provide the SOF and SOF augmenting helicopters with additional ECM equipment and radios. To support these helicopters, we are modifying 20 additional HC-13 Os and six MC-13 OEs to refueling tanker configurations. We're increasing the survivability of the SOF AC, MC, and HC-13 Os by adding additional radar warning receivers and infrared countermeasures pods. We are also conducting modest RDT&E and perhaps little known programs to improve SOF capability. Examples of this are our ongoing development and testing of a 40mm armor piercing round for the gunships using a tungsten fleshette, our development of a night vision goggle heads-up display device for all core and augmenting SOF aircraft, and our testing of the new Fulton surface-to-air recovery system, called Project 46, which will equip some of our Combat Talon fleet to pickup a team of up to six men in a single pass without landing. We are also completing procurement of a computer aided mission planning system that has been specifically designed for our SOF units. It provides a highly responsive planning capability that no other unit in the Air Force possesses. We are confident that the efforts and resources we are devoting to these SOF efforts will significantly improve the readiness and capability of our Special Operations Forces.

The research, development and acquisition activities of the Air Force are committed in a big way to the revitalization of the SOF mission at a high priority. Since 1982 and through our current Five Year Defense Plan, we have spent or programmed approximately $3.5 billion for SOF revitalization. We intend to meet our

commitment to modernizing our forces by 1990 despite recent budget reductions, and I'm confident we will.

Mr. Chairman, this concludes my remarks.

Mr. STRATTON. I don't think we ought to start messing the thing up here now. I am going to ask Mr. Scrivner, the staff leader, to get in touch with you people and let's get this thing straightened out so that we can proceed with something concrete rather than this vagueness that is apparently systemic with this organization.

Mr. LATHAM. In terms of what we thought you wanted this afternoon we are very specific——

Mr. STRATTON. You want to come up and get the dough, that is basically it, and that isn't what we want.

Mr. LATHAM. We misunderstood that you wanted an operational briefing and not a procurement briefing.

Mr. SCRIVNER. If I may intercede for just a moment. I think if you look at Mr. Stratton's statement, it lays out that what he wants to know, is what are we doing, what are we buying, how are we going to use it, and that cuts across the lines and it gets to the point that you have got a policy side of the House and you have a resource side of the House, and maybe that is one of the problems, that we don't see how they come together and that is exactly what I think the chairman is trying to point out.

Mr. LATHAM. Well, it is more than policy and resources. It is operations you have been asking about—how are these forces deployed, what equipment do they use and where and how. That is a different set of questions than we came prepared to answer today.

Mr. STRATTON. Well, let's adjourn the committee at this point and we will meet at the call of the Chair tomorrow to see if we can't get this thing squared away and maybe we can do it in the next hour or half hour, and get the thing started, but this is not really satisfactory.

[Whereupon, at 1:50 p.m., the subcommittee was adjourned.]

# FISCAL YEAR 1987 DOD/AIR FORCE PROGRAMS

House of Representatives,
Committee on Armed Services,
Procurement and Military
Nuclear Systems Subcommittee,
*Washington, DC, Tuesday, March 11, 1986.*

The subcommittee met, pursuant to call, at 9 a.m., in room 2212, Rayburn House Office Building, Hon. Samuel S. Stratton (chairman of the subcommittee) presiding.

## STATEMENT OF HON. SAMUEL S. STRATTON, A REPRESENTATIVE FROM NEW YORK, CHAIRMAN, PROCUREMENT AND MILITARY NUCLEAR SYSTEMS SUBCOMMITTEE

Mr. Stratton. The subcommittee will come to order.

This morning the subcommittee will receive testimony from the Department of the Air Force on its major fiscal year 1987 procurement programs. The subcommittee is particularly interested in a number of the programs. Specifically, the tactical fighter roadmap, which includes the F-16, the F-15E programs, the status of air defense competition, the C-17 airlift initiative, the Air Force One replacement, the T-46A trainer aircraft, and the AMRAAM missile.

With regard to the AMRAAM, we have the General Accounting Office with us to discuss the certification question. It would be the Chair's plan to consider the AMRAAM Program as the last item on the agenda and have the GAO witness present his discussion following the Air Force testimony.

In the afternoon, the subcommittee will hear about the Air Force Space Program. With the *Challenger* tragedy, we will want to reevaluate the complementary Expendable Launch Program.

Our principal witnesses today are the Honorable Thomas E. Cooper, Assistant Secretary of the Air Force for Research, Development, and Logistics; and Lt. Gen. Bernard P. Randolph, Deputy Chief of Staff for R&D and Acquisition; and James Hinchman, deputy general counsel to the GAO.

Dr. Cooper, do you want to lead off?

## STATEMENT OF HON. THOMAS E. COOPER, ASSISTANT SECRETARY FOR RESEARCH, DEVELOPMENT, AND LOGISTICS, DEPARTMENT OF THE AIR FORCE

Dr. Cooper. Thank you, Mr. Chairman.

In the interest of time, I would like to dispense with my opening statement. We have a fairly lengthy statement, joint statement by General Randolph and myself, we would like to submit for the record.

The next chart shows you the two pieces of the pie we are going to be discussing this morning, the tactical programs account for about 30 percent of the Air Force's budget. I will start immediately into the priorities and give you a rundown on the priorities which, as you recall, is the same set that you have seen now for a number of years. In the case of strategic forces, the B-1 is going to achieve its IOC in September of this year, and the Peacekeeper will achieve its IOC in December of this year, so both of these strategic programs are moving along quite smoothly.

FY 1987 AIR FORCE BUDGET PRIORITIES

FY 87 priorities reflect commitment to "stay on course" and continue addressing improvements most vital to combat capability.

Modernize strategic forces [offensive and defensive].

Improve readiness and sustainability of general purpose forces.

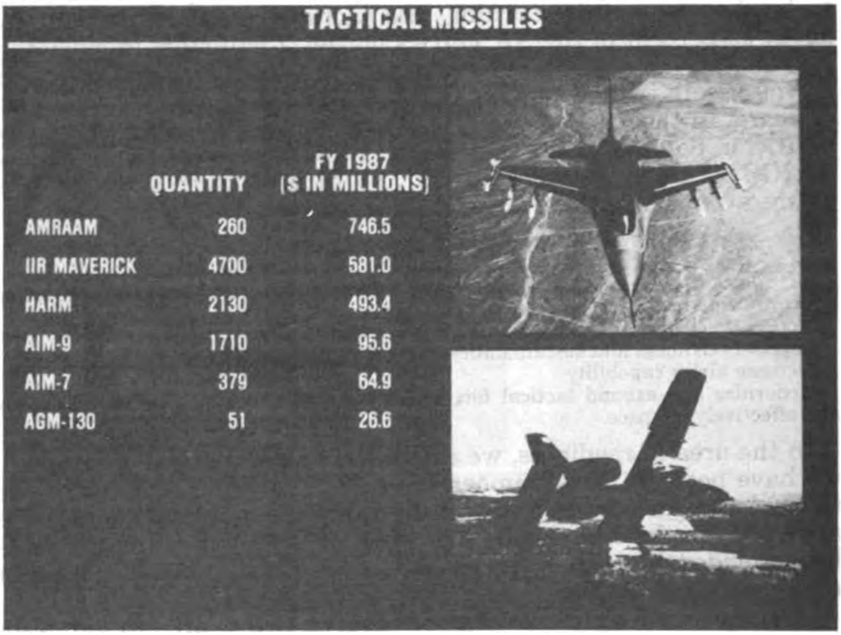
Increase airlift capability.

Modernize and expand tactical forces and improve ability to operate efficiently and effectively in space.

In the area of readiness, we are in the best shape, Mr. Chairman, we have been in for a number of years. That is 85 percent of our tactical airplanes sitting out on the ramp today are in commission and ready to fly, and that is the result of the support the Congress has provided to ensure the spares necessary to get that kind of readiness are there.

In the area of airlift, we have delivered two C-5B's to our Military Airlift Command and by the end of the year, we will have nine flying the line, and we will be talking about the modernization of the tactical forces, but a major part of the modernization is to make sure the Reserve Forces have modern equipment, and, in fact, we will modernize the Reserve Forces at the rate of about four squadrons per year.

Finally, in the area of space, the Consolidated Space Operations Center at Colorado Springs, the facility has been completed, and we are actually working with spacecraft; namely, GPS spacecraft, at that facility today. So we are making progress in achieving our priorities.




Let me go into the tactical programs, beginning with the missiles. As has already been noted, the advanced medium-range air-to-air missile will be discussed as a special topic, but by way of an aside, we just completed our fifth successful flight this past Friday on the missile and the program manager will be discussing that with you in greater detail.

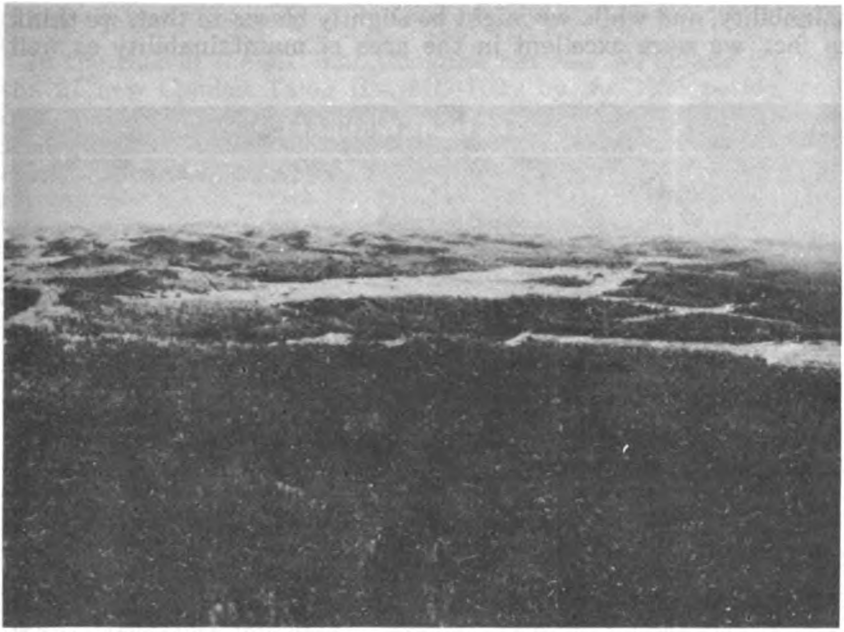
I will talk a little more about where we stand on the infrared Maverick missile and the other programs that you see here. If you have any questions on those, I would be pleased to address them. Otherwise, I will have nothing further to say about those programs.

FOLLOW ON TEST AND EVALUATION (FOT&E) LAUNCH RESULTS

| Date | Location | Hits/launches | Percent |
|---|---|---|---|
| May-Sep 1984 (AFOTEC) | Eglin AFB, FL | 14/17 | 82 |
| Jul-Sep 1985 (AFOTEC) | Nellis AFB, NV | 11/12 | 92 |
| Sep-Nov 1985 (TAC) | Nellis AFB, NV | 13/13 | 100 |
| Overall launch results | | 38/42 | 90 |
| Simulated launches: Oct-Nov 1984, (AFOTEC) | Volk Field, WI | 38/42 | 90 |

The next chart then, I will talk a little bit about Maverick. It has been stated in some quarters that the Maverick does not meet the requirements. The fact is, as you can see from our follow-on test and evaluation record, since May 1984, we have achieved in test and evaluation a 90-percent hit record, which I think is quite remarkable for this type missile.

In addition to the actual live firings we see here, we have also conducted a number of simulated launches, and the purpose of those simulated launches was to make sure that we had the opportunity to work against targets that would be the type you would see in the European environment, and if I may, here I will show you a picture of the area around the fort up in Wisconsin, and you see every tree line here. It really is a very heavily wooded area, so it presented quite a challenge for the fighter pilots to be able to find the targets.



IRR MAVERICK OPERATIONAL TEST & EVALUATION

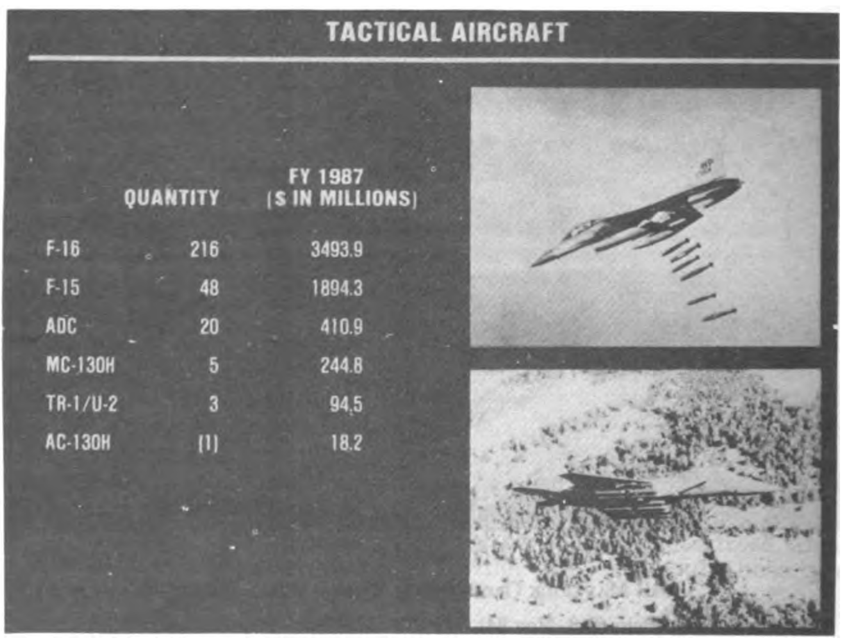
Volk Field, Wisconsin (Oct–Nov 84).
Realistic testing in an operational environment: Unfamiliar Terrain; Soviet armored formations in heavily wooded area; simulated battlefield smoke, fires and anti-aircraft.

The next chart, please. You see on this chart that we tried to make this operational environment as realistic as we possibly could, with unfamiliar terrain, and we made sure that we simulated the Soviet armed formations in the heavily wooded areas. We had tank formations in the middle of the smoke and antiaircraft fire. The point is we made this exercise as realistic as we could, we took line fighter pilots to work the problem, and they succeeded quite well in being able to detect the targets.

FOLLOW ON TEST AND EVALUATION (FOT&E) MISSILE OPERATIONAL SUITABILITY

| Objective | Rating | Accomplishment |
|---|---|---|
| Incoming Reliability | Excellent | Required 95 percent/actual 98 percent. |
| Logistics Reliability (training missile) | Excellent | Mature system MTBM 36 housr/actual 39.3 hours. |
| Maintainability | Satisfactory | All maintenance actions within thresholds. |

And then finally our score card. As the result of this test and evaluation effort from the independent testing, they rated us excellent in the areas of reliability and satisfactory in the area of maintainability, and while we might be slightly biased in that, we think, in fact, we were excellent in the area of maintainability as well.




Now, I will switch and talk about the tactical fighters. I will actually cover all of these in two different segments of the briefing.

First I will discuss very briefly where we stand on the Special Operations Forces, the so-called SOF Forces, and then I will get into the tactical fighter roadmap that the committee asked us to review. First, with regard to the MC-130's, as you can see here, at the top of this chart, we show the current force structure. The Congress has enjoined us to step out smartly with the planned force structure to make sure we achieve a number of goals Congress has set for us.

AIR FORCE SPECIAL OPERATIONS FORCES

| | MC-130 | CV-22 | AC-130 | HC-130 | HH-53 | H-3 |
|---|---|---|---|---|---|---|
| Current force | 14 MC-130E | 0 | 10 AC-130H | 20 HC-130H | 7 pave low | 6 H-3 |
| | | | 10 AC-130A | 30 HC-130P/N | | |
| Planned buy | 21 MC-130H | 80 CV-22 | 12 AC-130 | | | |
| Planned mods | | | | 20 H Models to P Models | 12 others to pave low | |
| Planned force | 14 MC-130E | 80 CV-22 | 22 AC-130 | 50HC-130 P/N | 19 pave low | 6 H-3 |
| | 21 MC-130H | | | | | |

In the case of the MC-130, Congress has said we should buy out the 21 new Combat Talon II's, MC-130's by the 1995 period, and our new budget that we are submitting this year for fiscal year 1987 to the Congress allows us to do that. That is about a 2-year acceleration from the previous budget, bringing us to the force structure you see here of Combat Talon II's I's and II's in the MC-130's.

We are also working very closely with the Navy on the CV-22 Program, and, as you recall, the Navy is in charge of that program. The Air Force has certain specific requirements which we have included in our budget, and we are working closely with the Navy to assure that we achieve the goal of 80 CV-22's.

Mr. STRATTON. Is this classified?

General RANDOLPH. The CV-22's? No, sir.

Mr. STRATTON. Are those all C-130's?

General RANDOLPH. Here.

Mr. STRATTON. You have MC-130's, and HC-130's?

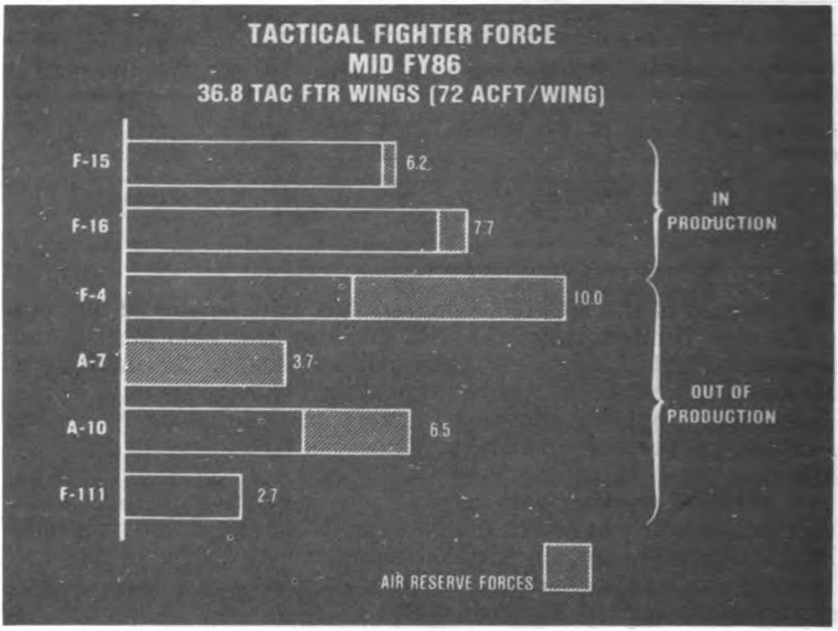
General RANDOLPH. That is right, those are designed especially for the special operations forces. They have the radars, the infrared equipment, the ECM equipment necessary to penetrate hostile areas. The HC-130's are refueling aircraft, the AC-130's are gunship airplanes, and these are helicopters, and they have similar equipment on the helicopters to that equipment that you have——

Mr. STRATTON. What are the ones that fly you into the South Pole?

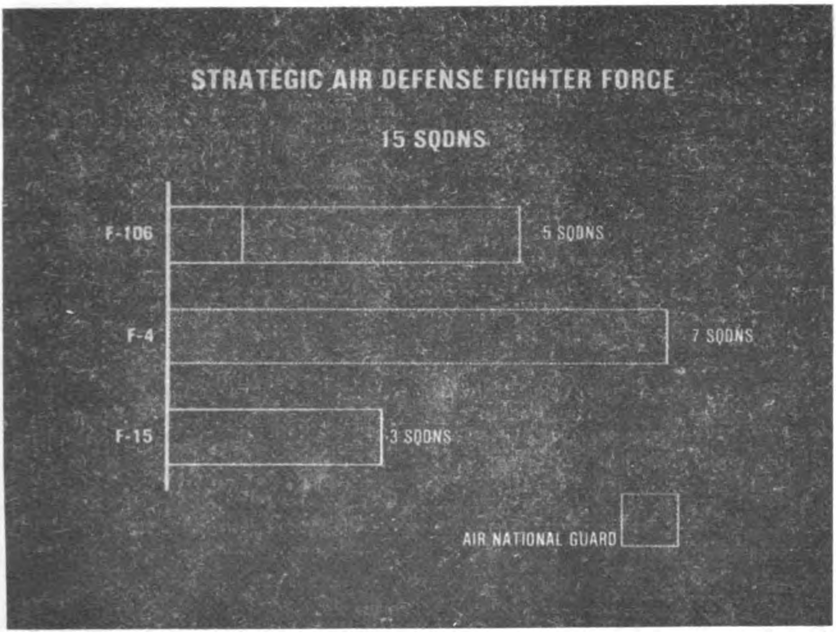
General RANDOLPH. You mean ski birds? Those are just airlift birds, if that is what you are talking about. They have no special equipment except skis and that sort of thing.

Mrs. HOLT. They are pretty good.

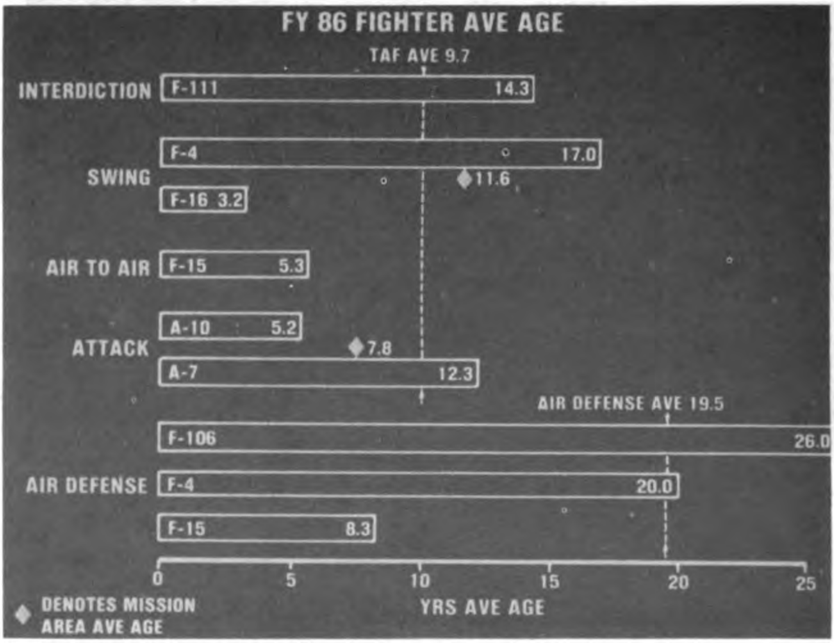
General RANDOLPH. Mr. Chairman, they are all C-130's. It is just a matter of the electronic equipment you have on board. They are all basically the same airplane. The point is that we believe now that our planned force does indeed meet the Air Force's portion of the Special Operations Forces, as has been directed by Congress.



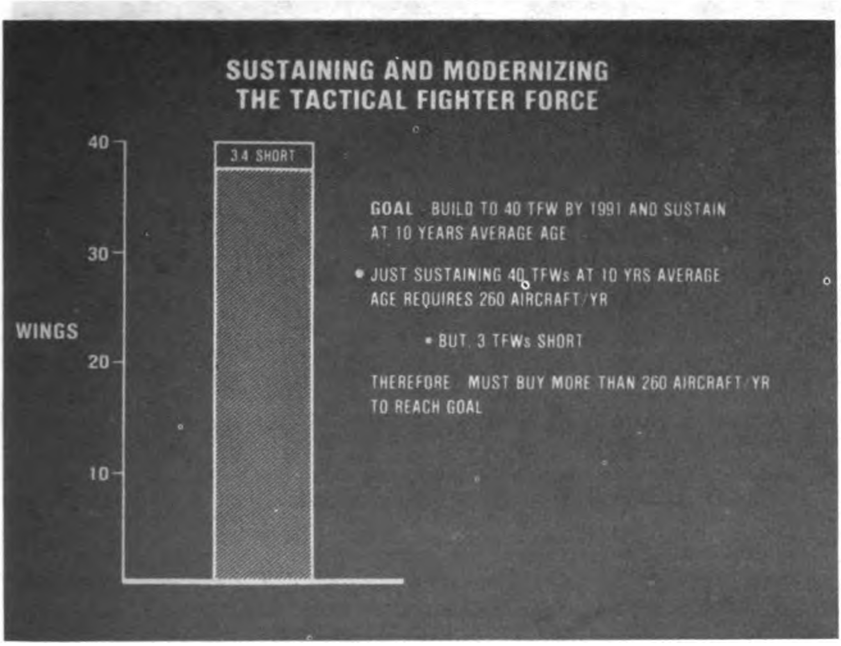

With that, I will switch and talk a little about the fighter force. The next chart talks as to where we are today as of the middle of this fiscal year, the number of tactical fighter wings, and the shaded part in green shows the pieces in the reserve forces. As you recall, one of the things that we are going to do is to begin replacing these F-4's at the rate of about four squadrons per year with the newer F-16's.



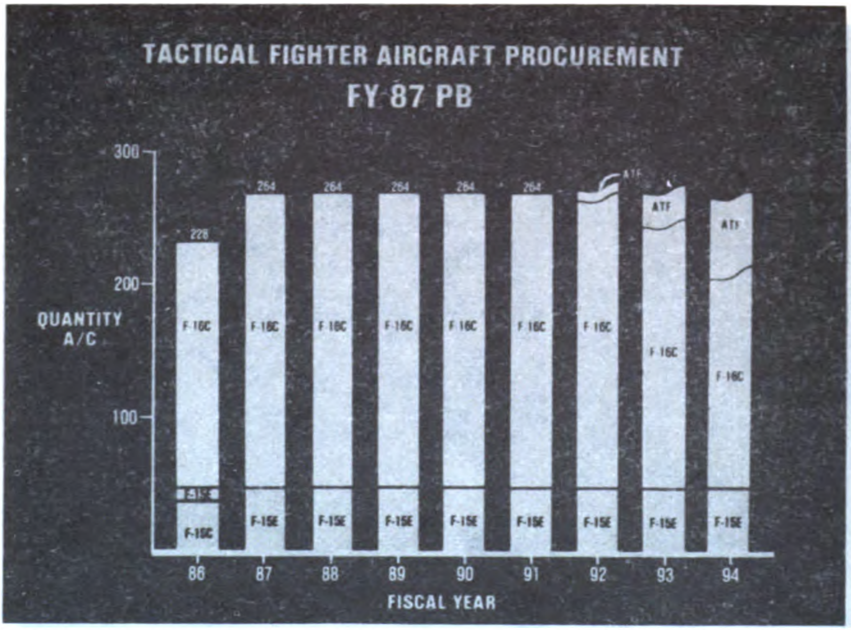

This shows you where we are now, the next chart will show you where we are in air defense. There are 15 air defense squadrons, 3 of those are the more modern F-15's. When we get into the competition, which I will cover in a few minutes, the air defense airplanes you see in the shaded area are the ones we intend to replace.




Finally, as an overview, this next chart talks a little bit about the age of our tactical fighter forces, and as you can see, they are an average of about 10 years, but you can see our air defense forces are now approaching 20 years and clearly need to be replaced, and that is what we are proposing to do with our air defense competition.




Now, first I have a couple charts that talk about the fighter portion and the number of tactical fighter wings. Our goal is 40, as you recall. That was our goal last year. We are still short. In order to achieve that goal, simply to keep level at about 10 years average, it takes about 4.5 airplanes per wing to stay at the average. So if you did the arithmetic, took the number of wings we have right now, that is about 237 airplanes just to maintain that average age. If you want to increase to this 40 wings and still roughly keep that average age, then you are talking on the order of about 260 airplanes a year in order to achieve that goal.




And as the next chart shows you, our proposal to the Congress is that we do precisely that, at the 264 level, 216 of the airplanes are F-16C's, and 48 of the airplanes are F-15E's.

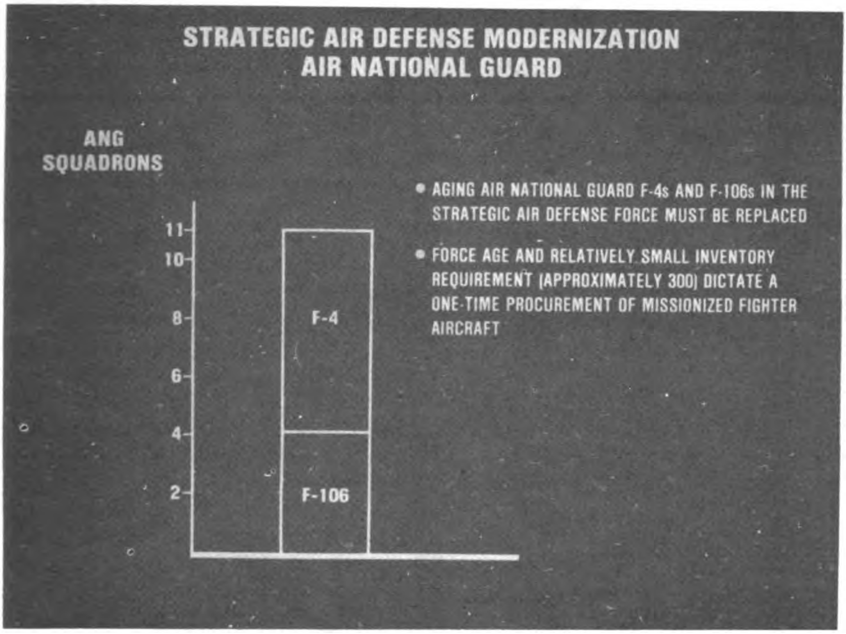
Mr. STRATTON. What has happened to the F-20?

General RANDOLPH. Sir, the F-20 will come into the equation in the air defense part of the force, and I will talk to that in a couple minutes.

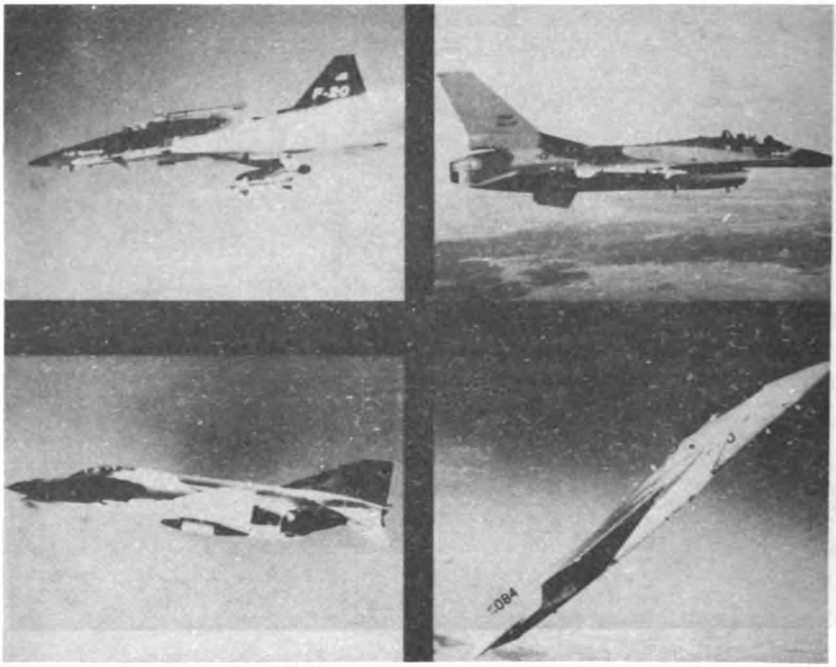
Now the F-16C's, they are all Cs. They have different blocks of the F-16C's, but every one of those is an F-16C. In the case of the F-15E, that is a dual role fighter, and that not only does the long-range interdiction, but it is also capable of air superiority work. So it is a very important part of our request that we continue on with the F-15E.

Dr. COOPER. General Randolph, if I might comment briefly, if you remember, Mr. Chairman, a couple years ago when General Russ and I first presented the tactical fighter roadmap, we pointed out that modernizing the air defense forces was separate and distinct from the tactical fighter roadmap. It still is, and the aircraft that we propose to procure there will be over and above the ones we show here and separately funded.

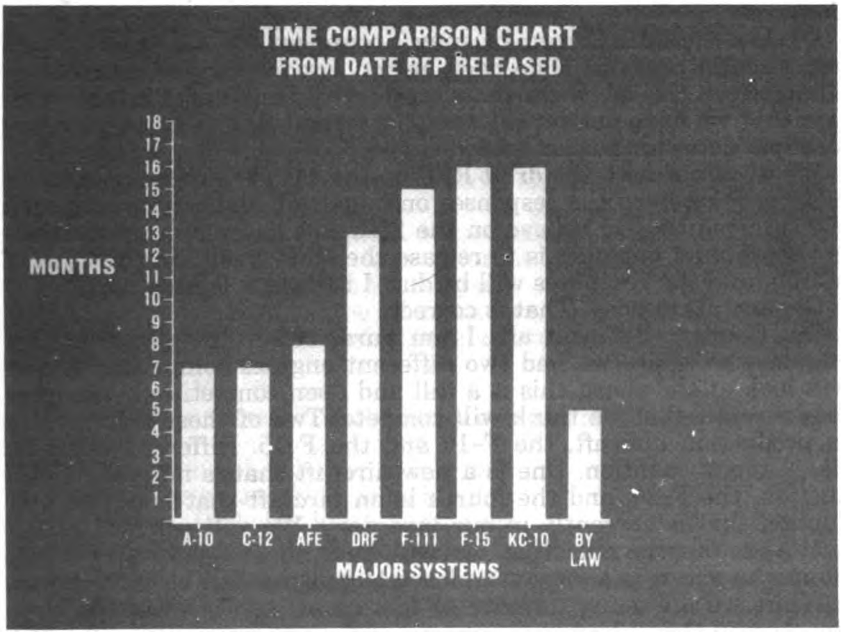
General RANDOLPH. In fact, in the next chart I will go into that.




**As you can see right here, these are 11 of the 15 squadrons I talked to you about earlier in the air defense force. These are fairly old airplanes, and they have to be replaced in short order. There are about 300 airplanes there, and that is what our air defense competition will cover. That is, the air defense competition is a request to buy 300 airplanes in a competitive environment.**




The next chart, you see who the players are in the competition. The F-20 that you mentioned earlier is one, the F-16, the F-4, and the F-15. When we put our announcement in the Commerce Business Daily, we got responses from contractors who were interested in proposing those four fighters that you see on that chart.




Now, the next chart talks to the issue of how long does it take to select the contractor to actually buy the fighters? And what you see here, Mr. Chairman, is the source selection time from the time our request for proposal is released until we go on contract, and this is to this point a historical record. That is, this is what has taken place—I have been involved in a number of these, and I will have to say being able to do the alternate fighter engine release in 8 months was a special case. It was a special situation.

The F-15 source selection is probably more of the type that would relate to the air defense fighter buy that we have today. If you take a look at what we have done historically, and then you take a look at the situation that exists in the law right now, you can see that the law demands that we select a source at a much faster pace than we have ever done in the past. Based on my experience, I just don't think that is possible. Of course, our position, the official Air Force position, is we are going to give that our best try, but our experience simply shows it is going to be difficult, if not impossible, to get there.

Mr. STRATTON. Is it correct that the Air Force is not going to be able to award a contract using fiscal year 1986 funds for the air defense aircraft until October or November of this year?

General RANDOLPH. Mr. Chairman, what the Air Force will do is try its best to award a contract before the end of the fiscal year. I am simply saying it is my experience that is going to be very difficult to do. As you recall, this is procurement money, so, therefore, it is 3-year money, and we could award a contract in the November

timeframe using the $200 million that was appropriated by the Congress.

Dr. COOPER. Mr. Chairman, may I comment for a minute? Could you put the previous slide back on for a moment? I would like to point out to the members the situation we face, and I might mention that we have not yet released the formal RFP. Let me give you a couple dates for your consideration.

We went out with the draft RFP on the 11th of February, and we have now received the responses on our draft request for proposal. We received those I believe on the 28th. We are currently evaluating those, and our plan is to release the RFP, itself, on the 24th of March, and the responses will be due, I believe it is May 9.

General RANDOLPH. That is correct.

Dr. COOPER. But you all, I am sure, recall the great fighter engine war where we had two different engines competing. If you will look at the chart, this is a full and open competition. We have four aircraft that we think will compete. Two of those aircraft are in production aircraft, the F-16 and the F-15. Different capabilities, I might mention. One is a new aircraft that is not yet in production, the F-20, and the fourth is an aircraft that is out of production that is currently in our inventory. We will get four different types of proposals that we will have to evaluate, and I just submit to you it is a very complex selection we will be involved in.

While we are going to move as fast as we can to meet the time lines set by the Congress, we also want to do it in a very professional way, because I fully expect there will be as much attention on this source selection as there was on the great engine war. And there you had two different engines, here you have four different machines. So if we get the proposals in mid-May, the law currently says we should make a source selection by July 1. I don't know how we get there from here, to be very candid about it.

The law then goes on to say that no later than 60 days after that, and that would be September 1, we will have to be on contract. The law also provided us $200 million. I think if you look at the next chart——

Mr. STRATTON. Does this need to be done in 1987?

Dr. COOPER. I don't think it needs to be done so much in 1987. The moneys that have been provided are 3-year moneys. The only thing that constrains us is the September 1 date. We will be close to September 1. We may be a month or two away if we don't meet September 1. I believe the intent of the Congress was to push this competition and make sure we move out as fast as we possibly could move out. I want to assure you we are moving out——

Mr. STRATTON. Where does that September 1 date come from?

General RANDOLPH. That is in the law. The law says we have to make the contract award 60 days after the source selection, which is September 1——

Mr. STRATTON. I don't recall that in the law when it went out from this committee.

Dr. COOPER. It did not. It came out of the continuing resolution.

Mr. STRATTON. Another committee?

Dr. COOPER. Of Appropriations.

Mr. STRATTON. Of the other body?

Dr. COOPER. Yes. It was a combined action. It kind of cropped up, I think, in the conference, itself.

Mr. STRATTON. They didn't even check with us.

Mr. COURTER. Tom, can I ask you a question on the fighters? What is going to be the mission of these fighters? Are they for the defense of the continental United States?

Dr. COOPER. Air defense.

Mr. COURTER. Doesn't the F-15 have an entirely different range than the other ones?

Dr. COOPER. That is the point I was making. It is a full and open competition, and you have four different machines that are going to be bid, and the answer to that is yes.

Mr. COURTER. Well, three of them are kind of low mix, right? And the other one kind of stands out much different than the others?

Dr. COOPER. Yes, it does.

General RANDOLPH. The F-15 has considerable more range than either the F——

Mr. COURTER. It has better radar, too?

General RANDOLPH. That is right.

Dr. COOPER. Probably has a higher cost.

Mr. COURTER. Can the F-15 engage Soviet Backfires before they deploy these cruise missiles without refueling?

General RANDOLPH. Now you are getting into a scenario question. The F-15 could engage at longer ranges and now if you want to get into specifics about how, what the threat is and how that is going to be played, we have to discuss it in a more sensitive session.

Mr. COURTER. We can't discuss it now.

General RANDOLPH. In a general sense, it has a much longer range than the F-4 or the F-16, for that matter.

Dr. COOPER. I think the point is all these aircraft will give us a better capability than we have today in that area. Clearly the F-15, if cost were no object, would probably be the superior machine from a range/radar volume point of view. But that will have to be looked at.

Mr. COURTER. Do you anticipate refueling needs if you go with the F-4, F-20, or F-16?

General RANDOLPH. Refueling will be involved under certain scenarios, but, sir, keep in mind that we use the F-4 right now today, the largest number of aircraft we have in the force are F-4's.

Mr. SKELTON. May I make an inquiry?

Mr. STRATTON. Mr. Skelton.

Mr. SKELTON. I think we have to get into the scenario. Otherwise it is a bunch of countless numbers. This may not be the time or place to do it, but I think we have to do that.

Mr. COURTER. It is my understanding we are going to go into the scenario, but it has to be closed session. Is that right?

General RANDOLPH. My opinion is we would have to go into closed session.

Mr. COURTER. I think we have to.

Mr. SKELTON. I couldn't agree more.

Dr. COOPER. Let me just assure you that is one of the things that is going to be considered in the competition, is that we will look at the scenarios and the various missions that these aircraft are han-

dling, but I think if for no other reason, because of the source selection sensitivity, if we are going to discuss some of those things, we will have to go closed.

General RANDOLPH. One of the things that takes time, as you go into the source selection process, is to do this scenario analysis Dr. Cooper talked about, because there are four different machines.

Dr. COOPER. It is not beyond the realm of possibility some combinations of aircraft could fill that mission, some combination of F-4's and F-16's, F-4's and F-15's, and again I would just point out the complexity of the competition, itself, and the point we were making in terms of the time lines, I think Congress was anxious to have us move forward as fast as we can, but I think it is also the clear intent of Congress we do the sort of mission scenarios you speak of and do a professional job on this. And I personally believe that the times that have been set and the professional job you would like to see done are in conflict.

General RANDOLPH. Let me make two comments about the question of range. If you are talking about deploying the fighters to Alaska, you need more range in Alaska, and that is where we put our F-15's, so we have already done that. When you are talking about within the continental United States, right here on the continent, then we believe that the shorter range airplanes are adequate. We prefer to have the longer range because that makes the job easier, but that doesn't mean the shorter range airplanes could not do the job because they are doing the job today.

Another point is the F-20 has more range than the F-4's.

Mr. COURTER. Maybe you can't get into this. When you say they are doing the job today, the question I have is, can they engage Soviet Backfires before they deploy cruise missiles?

General RANDOLPH. You need to understand our primary job in the air defense world is not necessarily shooting down the airplanes, the primary job is to make sure——

Mr. COURTER. You can't shoot down cruise missiles?

General RANDOLPH. We have the technical capability to shoot down cruise missiles. The problem is there are so many. They can overwhelm the system. The real issue we are trying to get at, though, is to make sure we have enough airplanes so that we can handle the lower level threats and that we have sufficient airplanes that we can at least mitigate the threat. We don't pretend to have enough airplanes right now to be able to engage all the bombers that would ever attack the United States. There just aren't that many.

AIR DEFENSE COMPETITION PLAN

**One time-Winner take all competition for 300 aircraft.**
**Full and open competition.**
**Must be an "existing" aircraft—no government funding for development.**

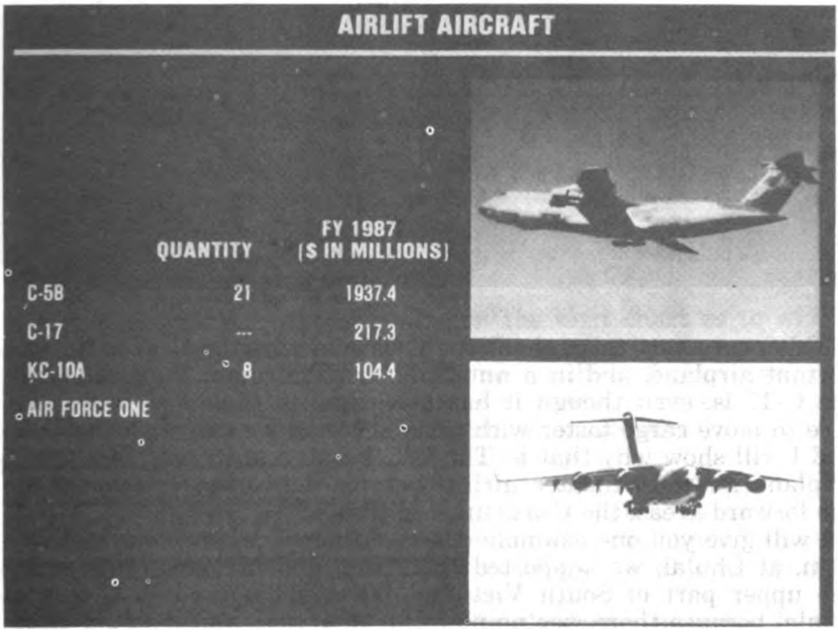
PROCUREMENT PROFILE

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fiscal year | 86 | 87 | 88 | 89 | 90 | 91 | 92 |
| Quantity | 10 | 20 | 60 | 60 | 60 | 60 | 30 |

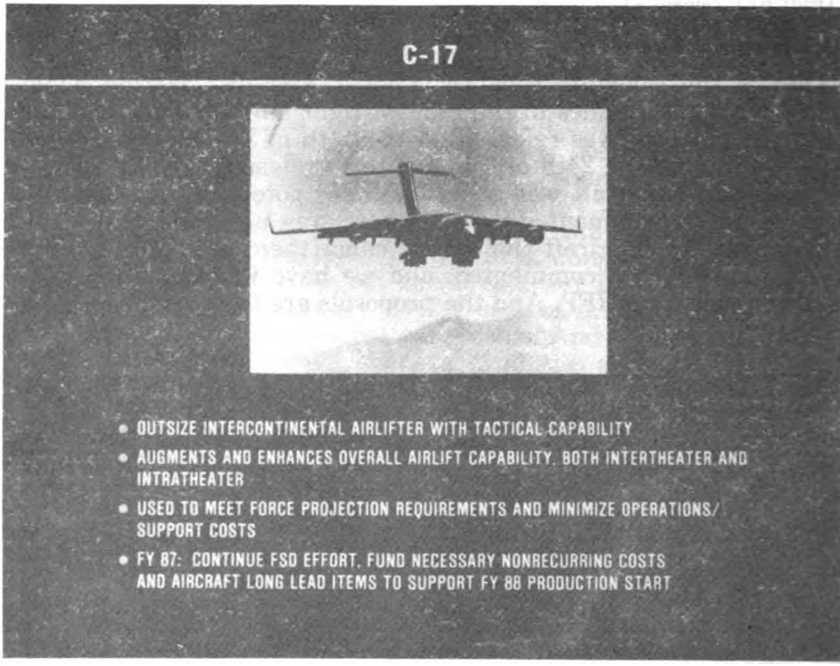
AGGRESSIVE COMPETITION SCHEDULE

Draft RFP release—11 FEB 86.
Final RFP release—24 MAR 86.
Proposals received—9 MAY 86.

This is the schedule that Dr. Cooper was just talking about. There are 300 airplanes in the request right now. And the draft request for proposal was released on the 11th of last month, and we are planning on the 24th of this month to release the final request for proposal. The draft was given to all the potential contractors to allow them to comment, to see if there was anything they could find onerous in the draft that would cause them problems. Each of the contractors has commented, and we have included their comments in this final RFP. And the proposals are to be received, then, on the 9th of May.

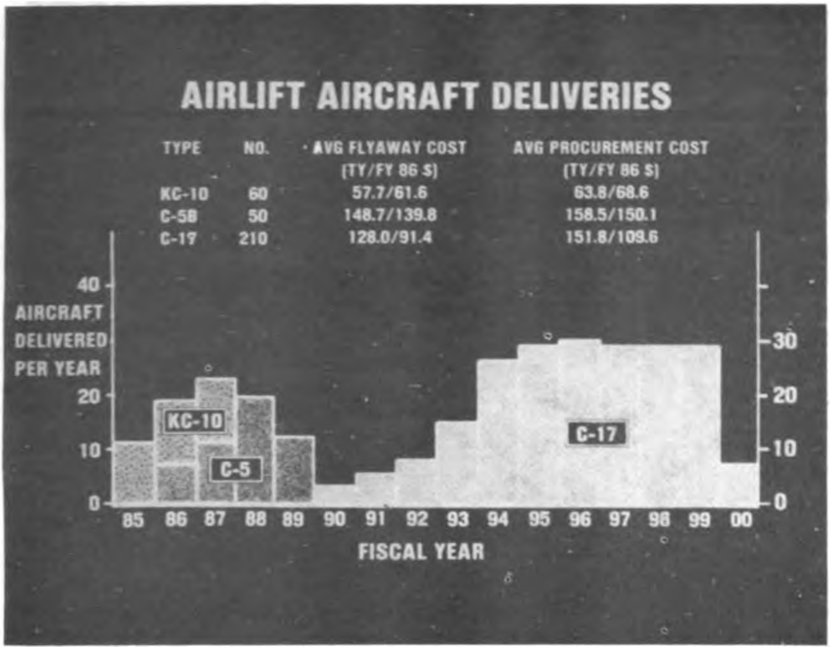



I will switch now and talk a little bit about the airlift question. The C–5B, of course, is fairly straightforward. We are buying those at a current fixed price. What I would like to do is discuss the whole airlift equation and after I get done with that, I will talk briefly about Air Force One and address any questions you have in that area.




This next chart talks about the C–17 and why the C–17 is an important airplane, and in a nutshell, Mr. Chairman, the issue with the C–17 is, even though it has less capacity than a C–5, we are able to move cargo faster with the C–17 than we can with the C–5, and I will show why that is. The C–5, because of its size, is a great airplane for inter-theater airlift, but for delivering equipment to the forward areas, the C–5 cannot do that.

I will give you one example. I was stationed, when I was in Vietnam, at Chulai, we supported the Army and Marines. That is in the upper part of South Vietnam. We could not put a C–5 into Chulai because there was no place for it to taxi, and it would close the airfield. So, therefore, C–5 offloads had to go to Da Nang and be trucked or shipped down to Chulai. That is the kind of capability, however, that the C–17 would have, and that is the problem the C–17 would solve.




Let me just refresh your memory on the next chart as to what we propose in terms of our buy of C–5's and C–17's. The point to this chart is, if you take a look at the number of airplanes, we don't have any spikes in that, that is we attempt to have a smooth delivery schedule so that we don't run into excessive budget requests as we go through the delivery process.

I also would like to call your attention to the fact that the C–5B cost in 1986 dollars, and this is total flyaway cost, is more expensive than the C–17. However, I will show in another chart, because of its greater gross weight carrying capability, the C–5 can carry more in a gross weight sense than a C–17.

Mr. STRATTON. I saw the C–17 out in California a month or so ago, and I would like to get an analysis of exactly what that will do in comparison to the C–5.

General RANDOLPH. I think I am going to give you that right now, Mr. Chairman.

have enough MX's, we should build more B–1's. What rationale is there to that, that we ought to build more B–1's? What is it? A $200 million bomber to make up for the MX's that we don't have?

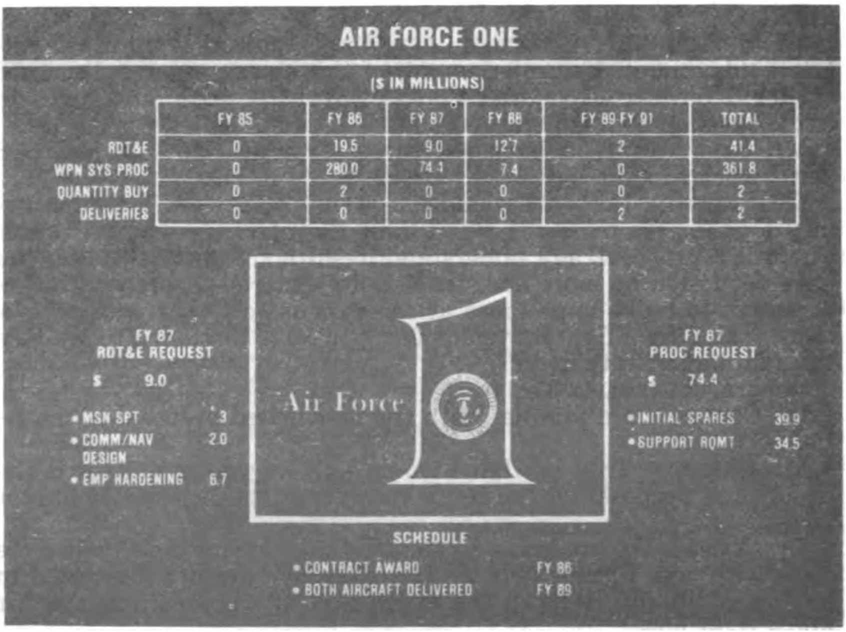
Dr. COOPER. I haven't thought that scenario through, Mr. Stratton, but I guess what I would say on behalf of the administration, we are still hopeful that we will get the second 50 MX's, the administration is still committed to that—to be followed by the small ICBM. That is no different than the explanation I just gave on the bomber. I think you will see when we talk about the ICBM program, we have got a considerable amount of money dedicated to the small ICBM. There is still a considerable sum of money dedicated to the MX and test missiles and those assets, and even under those circumstances, we are not interested in buying additional B–1's.

Mr. STRATTON. OK. Thank you.

Any other questions?

Let's go into Air Force One.

General RANDOLPH. Last stop, Air Force One.




| | FY 85 | FY 86 | FY 87 | FY 88 | FY 89-FY 91 | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 0 | 19.5 | 9.0 | 12.7 | 2 | 41.4 |
| WPN SYS PROC | 0 | 280.0 | 74.4 | 7.4 | 0 | 361.8 |
| QUANTITY BUY | 0 | 2 | 0 | 0 | 0 | 2 |
| DELIVERIES | 0 | 0 | 0 | 0 | 2 | 2 |

Sir, as you recall, the money that you see up here on the chart, $280 million was appropriated in fiscal year 1986 to buy two airplanes. In addition to the money for research and evaluation, money was appropriated primarily to work the issues of electromagnetic pulse hardening and to do the kinds of things necessary to insure you have a good communications platf^rm for the President to fly in.

In addition to that, in fiscal year 1987, we are requesting the moneys that you see here to buy some additional spares and addi-

tional support equipment that you see on the chart. I have taken a look at the proposals. It is my view that the money that we are asking for in this budget is adequate to buy the two airplanes. We hope that the Congress will agree with us and can proceed forward with the acquisition of the two airplanes, but, as you recall, the money was not authorized in the authorization process.

So we have sent, or are in the process of sending, a request over asking for your concurrence to proceed on with the acquisition of these two airplanes. We will be ready to sign the contract in May if the Congress agrees with us that it is OK to do so.

Mr. STRATTON. You got a lot of numbers up there. How are we going to select an aircraft?

General RANDOLPH. We are in the source selection process right now. We have two bidders. The two companies that meet the requirement are Boeing and McDonnell Douglas, and they have both submitted proposals.

Mr. STRATTON. The DC-10?

General RANDOLPH. A version of the DC-10, yes, sir, and the 747. The 747 and the DC-10 are the two competitors being looked at.

Mr. STRATTON. Can you give us some of the comparison between the two?

General RANDOLPH. Both the DC-10 and the 747 meet all the minimum requirements that we have established, so it is now a question of how well do they meet those—and I can't go into that—and who gives us the best price tag to select from.

Mr. STRATTON. Aren't they both oversized for that role?

General RANDOLPH. In fact, in terms of the space requirements, the current airplane, the VC-137, is significantly undersized to meet the requirements of the White House.

Mr. STRATTON. We are not supposed to carry the whole White House along, are we?

General RANDOLPH. No, sir. But, if you recall, the President has a rather significant communication requirement while he is flying on Air Force One. That communication requirement is large, bulky and has to be put on the airplane, in addition to having the necessary facilities for him to do whatever he needs to do on the airplane.

Mr. STRATTON. Since you have mentioned the communications equipment, is it correct that the equipment that Congress funded in fiscal year 1985 for the existing aircraft can be incorporated in the new aircraft?

General RANDOLPH. Yes, sir. In fact, we plan to do that. If you recall, you gave us permission to buy seven sets of communications equipment for the whole special fleet. That is the fleet we use to support the President and the members of his Cabinet. We have elected not to put those communications on Air Force One in order to put the communication suites on the new airplanes, assuming we buy the new airplanes.

So, yes, we are using those, and do not intend to put them on the other planes.

Mr. STRATTON. A commercial 747 without spares and interior finishing costs approximately $56 million, and a commercial DC-10 costs about $65 million. What are your costs based on?

General RANDOLPH. The DC-10, which we are buying off the commercial line, is actually $56 million, so it is even less than the number you show there. However, the special configuration and requirements of the airplane and electromagnetic pulse hardening in installing the communications equipment, in providing compartments for the President, all adds up to the price tag you see here. So the machine is configured to support the President, and it costs more money.

Dr. COOPER. Mr. Stratton, on the procurement cost, the total we have budgeted that was provided by the Congress last year, at least appropriated, was $280 million for two aircraft. The rest of those funds are either in the area of military construction, initial spares and support equipment and about $40 million for research and development. Some of that involves EMP hardening.

Mr. STRATTON. Will that require additional construction at Andrews?

Dr. COOPER. Yes, it will.

General RANDOLPH. Yes, sir.

Mr. STRATTON. You will have to enlarge the hangars?

Dr. COOPER. There will be a new hangar ramp that will house the two, the maintenance facilities, the security.

Mr. DAVIS. It sounds like a lot of money for R&D, $40 million.

Dr. COOPER. As you recall, our original estimate of the R&D bill was closer to $100 million. We have now brought that down to, I believe it is about $41 million. Is that not correct? About half of that is in the area of EMP hardening.

Mr. MAVROULES. On this particular subject, when you are talking about communications, what kind of money are you talking about relative to communications? Electronics for the airplane?

General RANDOLPH. I think I will have to provide that for the record. I don't have that off the top of my head.

[The following information was received for the record:]

AIR FORCE ONE COMMUNICATIONS MONEY

We intend to use two of the communications suites procured under the Special Air Mission (SAM) Communications Upgrade program to form the heart of the Air Force One replacement aircraft communication system. These suites must be redesigned and integrated for wide body aircraft as they were designed for the narrow body VC-137. We estimate that approximately $11.4M will be needed for this and the design and integration of other navigation and communication equipment. In addition, we estimate that approximately $8.0M will be needed to procure and install the navigation/communication equipment. The above costs are based on preliminary estimates and exact costs will not be known until source selection is completed sometime in May 86.

General RANDOLPH. Let me say this, the moneys we have in this budget are for the integration of the existing communications equipment the Congress has already provided into the airplane. The integration of that equipment into an airplane is a fairly formidable job.

Mr. MAVROULES. Are you going to put additional communications on Air Force One.

General RANDOLPH. No, sir, we are going to use the communications you have already provided to us.

Dr. COOPER. This is somewhat from the back of the rack, and I will correct it for the record if it's wrong, but I believe the seven

sets we received authority to buy last year from the Congress were somewhat less than $100 million. It is not cheap. Each set is expensive. That is the rough order of magnitude, and we will polish that off for you in the record. But it is not a few million dollars, it is more like $100 million.

[The following information was received for the record:]

COMMUNICATIONS EQUIPMENT INTEGRATION

The Special Air Mission (SAM) Communications Upgrade that Congress approved last year was for $106.3M. This program includes ground station upgrade, airborne qualification of secure telephones, and development of an improved mission communication system (MCS) for some aircraft in the SAM fleet. The cost for the airborne portion of the MCS upgrade is $74.8M. At the time the upgrade program was approved, we had not initiated the Air Force One Replacement Program; however, we intend to use two of the MCS kits from the upgrade program on the two Air Force One replacement aircraft. However, some additional funds will be required to install the MCS kits on the replacement aircraft. This money will be needed to integrate and redesign the system for installation on the wide body aircraft, design a third console position for an additional operator, and provide limited additional equipment to provide greater secure communications capability. The cost of this work is not yet known as the program is still in source selection and best and final offers have not yet been received.

Mr. MAVROULES. I have no argument with that, Tom. I would just like to know what the figures are. You talked about the MX missile before. I just want to assure you, you have got a rough road ahead of you. You are not talking about the intent of Congress, and we will get into that subject.

Dr. COOPER. I would like to point out in the area of communications, though, one of the primary purposes that we have in mind in this machine is to provide the President with secure communications, and you recall we have had a few incidents in the past in that area, redundant, survivable and communications that are global in reach. I really think we can stand no less for the President in this day and age. He has to be in constant communication with his people and his forces.

Mr. MAVROULES. I have no problem with that, Dr. Cooper.

Mr. SCRIVNER. General, may I follow up on this? If I understand the numbers, you are talking basically a little over $175 million an aircraft. Congress has already bought the communications packages for these two aircraft. What are your cost estimates based on? What have you really done? These are obviously parametric estimates——

General RANDOLPH. No, they are more than that. Let me, first of all—the number is about $200 million. It is $400 million roughly for two airplanes, so that is a total number. We came up with the numbers based on information that we got from the airline folks. They gave us the data on generally what they felt it would take.

Now, that is how we came up with our estimate. However, in the competitive environment, and by the way, that was one of the things, Mr. Chairman, that we were really interested in, because we knew this was going to be expensive, and we felt that the best course of action was to try to do this in a competitive environment while that DC-10 line was still open. As you recall, it is going to close shortly.

So we had two competitors. Both of those competitors have given us aggressive bids, and in my view, they are most anxious to do

this efficiently and keep the costs down as best they can. I will have to say that while the moneys that you see here are adequate, it is going to take some negotiation to make sure we stay at those numbers with the contractors. So it is just an expensive proposition.

Dr. COOPER. Mr. Scrivner, if I could, I would like to submit for your record a document I sent to Mr. Dickerson as a result of the R&D hearing we had. We have baselined this program now, and we have laid out what the content is. The document, itself, is secret. But if I could, I would like to submit that for your record, what the baseline program is.

[The following information was received for the record:]

AIR FORCE ONE COMPETITION

We provided the attached information to Representative Dickinson on 4 Mar. 86. It outlines the baseline requirements for the Air Force One Replacement Program and provides the best available cost estimates for the program.

[Classified by multiple sources Declassified by OADR]

The information shown below is based on our latest estimates of the amount needed to execute the program.

AIR FORCE ONE REPLACEMENT PROGRAM—GENERAL BASELINE REQUIREMENTS AND COSTS

[In millions of dollars]

| | FY 86 | FY 87 | FY 88 | FY 89 | Total |
|---|---|---|---|---|---|
| RDT&E costs: | | | | | |
| Comm/Nav design [1] | 9.4 | 2.0 | | | 11.4 |
| EMP hardening design [1] | 9.5 | 6.7 | | | 16.2 |
| EMP Testing—Systems level testing of the EMP hardening | | | 5.4 | | 5.4 |
| Flight/systems testing—Wide body FAA cert. and testing of antennas/interference/interoperability | | | 7.0 | | 7.0 |
| Mission support | .6 | .3 | .3 | .2 | 1.4 |
| Total RDT&E | 19.5 | 9.0 | 12.7 | .2 | 41.4 |
| Unit flyaway and nonrecurring costs | 280.0 | | | | 280.0 |
| Unit air vehicle—Two wide body commercial aircraft [2] | | | | | |
| Unit interior—Unique design interior [2] | | | | | |
| Unit Mission Communications system [MCS]—Integration/installation of GFE MCS [1 2] | | | | | |
| Unit EMP hardening [1 2] | | | | | |
| Unit avionics [2] | | | | | |
| Unit ECO [2] | | | | | |
| Nonrecurring [2] | | | | | |
| Total flyaway and nonrecurring | 280.0 | | | | 280.0 |
| Support costs: | | | | | |
| Peculiar support equipment | | 12.3 | | | 12.3 |
| Data | | 21.6 | | | 21.6 |
| Training | | .6 | | | .6 |
| Total support requirements | | 34.5 | | | 34.5 |
| Initial spares | | 39.9 | 7.4 | | 47.3 |
| MILCON: | | | | | |
| Maintenance and support complex | | 45.0 | | | 45.0 |
| Hangars both new aircraft | | | | | |
| Security system | | | | | |
| Automatic fire fighting system | | | | | |
| Hydrant refueling | | | | | |

AIR FORCE ONE REPLACEMENT PROGRAM—GENERAL BASELINE REQUIREMENTS AND COSTS—Continued

[In millions of dollars]

| | FY 86 | FY 87 | FY 88 | FY 89 | Total |
|---|---|---|---|---|---|
| Strengthened ramps/taxiways | | | | | |
| Houses maintenance/supply | | | | | |
| Total program costs: | | | | | |
| RDT&E | 19.5 | 9.0 | 12.7 | .2 | 41.4 |
| Flyaway and nonrecurring | 280.0 | | | | 280.0 |
| Support requirements | | 34.5 | | | 34.5 |
| Initial spares | | 39.9 | 7.4 | | 47.3 |
| MILCON | | 45.0 | | | 45.0 |
| Total | 299.5 | 128.4 | 20.1 | .2 | 448.2 |

[1] TAB: AF One Communication and EMP Hardening Requirements (S).
[2] (Breakout of these costs not available until after source selection is completed.)

AIR FORCE ONE REPLACEMENT AIRCRAFT COMMUNICATION AND ELECTROMAGNETIC PULSE HARDENING REQUIREMENTS (U)

1. (U) The Air Force One Replacement aircraft will use the equipment planned for the Special Air Mission C–137 midterm communications upgrade as the heart of the new communication system. This equipment will be government furnished to the Air Force One Replacement program. Some additional equipment must be government furnished to meet the replacement aircrafts' communication requirements. The communications system requirements are shown on the next page.

2. (S) Mission essential communications equipment for the replacement aircraft must be electromagnetic pulse (EMP) hardened to ensure that the President can communicate. [Deleted.] Contractors will propose which equipment needs to be hardened to ensure safe flight. They will also propose the type of hardening (bay, component, hull, pin or a combination) that is needed in order to provide a 26 decibel margin of protection over DOD MIL STD 2169. The communication equipment that must be EMP hardened is shown on the next page.

Dr. COOPER. Mr. Davis, back to your question about R&D. Let me just give you some sampling of the sorts of things we are doing in R&D in a rough order magnitude of what the moneys are. We have to design some unique communications and navigation gear for the aircraft. That is roughly $10 million of the R&D bill. When you get into the area of special electromagnetic pulse hardening and testing, which is not inconsequential for some of the key equipment on board the aircraft, that is another $20 million plus or minus.

And then you have the flight testing. Now, that is not flight testing of the airframe, per se, that is flight testing of this Communication antenna, which is what Air Force One is in this day and age. That, taken together, adds up to about $40 million.

You get into similar sorts of things in the procurement account when you look at the installations of the communications equipment, and I don't like it either, but believe me, the whole area of integration and installation is an expensive proposition. It goes far beyond the procurement of the basic airframe. The unique design of the interior, and it is uniquely designed for the President with his requirements. It is not just creature comforts, it is also the special Communication facilities that are on board, et cetera.

What I would like to do, if I could, is provide you with that background for your record.

Mr. STRATTON. Without objection, that will be included in the record.

Dr. COOPER. If I could just reiterate General Randolph's request, and we will have a letter over shortly, the situation that we face is that Congress provided $300 million to us last year. It was appropriated and not authorized. And the reason for that, the reason that we came out of cycle is that we did want to do this in a competitive environment, and the DC-10 line is going to go down shortly. And if we are to meet the DC-10 time lines, we need to get on with the competition, and if it is to win, we need to be on contract here within the next few months. That is the reason we approached you midterm, midcycle last year.

Where we stand is we have the money in hand. It is one of these issues of appropriation without authorization, and we would like to appeal to you to let our money go, and after we make the source selection in May, to go on contract. We have the money we need in hand. We have additional funds we are requesting in 1987 and 1988, but they are relatively small compared to the moneys that have already been appropriated.

Mr. STRATTON. In other words, you need an authorization, then, is that right?

Dr. COOPER. I think, Mr. Chairman, what we need is an approval. We don't need a formal authorization by statute. There is headroom within the authorization account where this appears. We have done this in the past, where we have come forward to the committees and requested your approval of items that were appropriated and not authorized, and we are in the process of doing that formally. It should be over shortly.

Mr. STRATTON. Mr. Ray.

Mr. RAY. Thank you, Mr. Secretary. General, good to have you here this morning. Thank you for your good straightforward presentation here.

Just a couple of simple questions. Do either one of these airplanes include air-to-air refueling, or is that something you would want in Air Force One?

General RANDOLPH. No, sir, Air Force One does not include air-to-air refueling. We believe the two airplanes in contention have the necessary legs to give the President a comfortable ride.

Mr. RAY. It probably could be put in at no extra cost, but you would see no need to refuel——

General RANDOLPH. I have done a lot of air-to-air refueling in my time, and I would be uncomfortable with air-to-air refueling with the President on it. I think that is probably something that we would not to do.

Mr. RAY. Of course, we don't know what the future holds in the way of that aircraft needing to fly a long time.

What about the medical facilities on the airplane? I had heard there might even be an operating room, is that correct?

General RANDOLPH. No, sir, but there will be minimal facilities to take care of emergency situations, nothing that I would consider elaborate or out of the ordinary.

Mr. RAY. Thank you, sir.

General RANDOLPH. Mr. Chairman, that concludes what I had to say in my presentation.

# VIII. Theater Forces

## A. Objectives

In order to protect our national interests and meet our extensive commitments, we must have forces capable of countering any conventional threat. Because of the magnitude of our global commitments and the time critical nature of our responses, our forces must have the capability to react and fight anywhere and anytime. To operate in this environment, we are placing high priority on modernization and expansion of our theater forces while continuing to emphasize readiness and sustainabilty.

## B. Tactical Fighter Program

### BACKGROUND

1. Rationale: At the core of our theater force capability is the tactical fighter force. This force must provide field commanders the flexibility to respond in an appropriate and timely manner to any contingency. This flexibility requires a fighter force large enough to do the job and one which possesses the proper mix of air-to-air and air-to-ground weapons delivery capabilities. Two years ago, we developed the Tactical Fighter Roadmap to guide us in achieving and maintaining that fighter force. Since then we have updated it in response to changing threats and fiscal constraints.

2. Soviet Threat: The Soviet Union and her allies continue to out-produce U.S. and our allies in nearly all weapons categories. This disparity has resulted in a Warsaw Pact numerical advantage of almost three to one over North Atlantic Treaty Organization forces in mobile armored systems with a similar advantage in tactical aircraft. Soviet technical advances in avionics, aerodynamics, and propulsion systems are narrowing our qualitative advantage. The Soviet's newest fighters (MIG-29 Fulcrum, MIG-31 Foxhound, SU-27 Flanker) are comparable to our frontline F-15 and F-16 aircraft. This quantitative and qualitative expansion presents the most serious threat to our theater forces. We are addressing that challenge by using our advantages in technology and tactics to provide our dedicated and well trained people the most capable equipment we can produce within present fiscal constraints.

3. Tactical Fighter Roadmap: The Air Force has established a force structure goal of 40 tactical fighter wing equivalents. Though this level falls short of that actually required, it represents a practical and fiscally achievable goal within the Fiscal Year 1987 Five Year Defense Plan. Reaching this goal, while maintaining the tactical fighter force at an acceptable average age of approximately ten years, requires that we increase our tactical fighter procurement to at least 260 aircraft per year. Our Fiscal Year 1987 request, consequently, is for 264 aircraft (48 F-15E and 216 F-16 C/D).

In addition to the tactical force, we have a pressing need to replace the aging F-4s and F-106s in our Continental Air Defense Force. In order to accomplish this in the most affordable and cost-effective manner possible, we are conducting a

competition for approximately 300 air defense aircraft. The competition will be conducted in Fiscal Year 1986 and will be open to all existing aircraft.

Aircraft competition is but one of the innovative approaches we are applying to build and maintain the forces required to protect our national interests. In addition, we are studying new modification programs for current inventory aircraft which may provide increased capability and supportability and thereby increase useful service life. We are also establishing cost goals earlier than ever before in the development of future systems and applying goals to operating and support costs as well as procurement. We have and will continue to explore every available avenue to build and maintain our forces at the required levels. The Tactical Fighter Roadmap will continue to be revised and updated so that we can achieve our objectives in the most cost effective manner possible.

## Fiscal Year 1987 PROGRAMS

4. F-15 Eagle

a. MISSION: The F-15E provides the dual capability of performing all-weather navigation, deep penetration, and night/under the weather air-to-surface attack, while retaining the basic air-to-air capabilities of the F-15A-D. We are adding the systems, such as Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) and a missionized rear cockpit, that the F-15E needs to perform its ground attack mission. The F-15E will complement the limited F-111 fleet. At comparable loads, the F-15E has less range than the F-111 but is capable of delivering a wider variety of air-to-surface munitions. In the air-to-air arena, the F-111 can defend itself while the F-15E can conduct offensive counter-air operations. The F-15A/B air superiority version was introduced into the Reserve forces with the activation of the first unit at New Orleans Air National Guard Base in October 1985.

*F-15 EAGLE*

b. STATUS: We accepted delivery of the first Multistage Improvement Program (MSIP) F-15 production aircraft in June 1985. The MSIP

program is designed to provide improvements to meet evolving threats. Improvements include software changes to the radar system, adding Advanced Medium Range Air-to-Air Missile (AMRAAM) capability, incorporating improved communications and identification equipment as well as updating the electronic warfare system. The MSIP F-15 configuration serves as the baseline for the F-15E.

With Fiscal Year 1987 Research, Development, Test and Evaluation (RDT&E) funds, we will continue testing of the integrated MSIP systems, MSIP Radar Electronic Counter Counter Measures updates, continue development of the Tactical Electronic Warfare Systems support equipment, and integration of an increased performance engine. F-15E unique tasks in Fiscal Year 1987 include hardware/software development, in-depth ground testing, and initial flight testing.

In Fiscal Year 1986, we will procure the last of the F-15 C/Ds and the first eight of a total of 392 F-15E aircraft. Our Fiscal Year 1987 request will purchase 48 F-15E aircraft. The first F-15E delivery is scheduled for December 1986.

5. F-16 Fighting Falcon

a. MISSION: The high performance multi-mission F-16 performs a broad spectrum of tactical air warfare tasks coupling exceptional air-to-air performance and potent air-to-surface delivery capability. The F-16, rapidly becoming the backbone of our fighter fleet, is replacing aging F-4s in the active and reserve forces. The F-16 is operated by 28 active and two reserve/guard units in air-to-air and air-to-surface roles. Five Air Reserve Force units will convert to the F-16 in Fiscal Years 1986 and 1987. The F-16 serves in the air forces of nine nations worldwide.

*F-16 FIGHTING FALCON*

b. STATUS: The F-16 continues to evolve in capability. We continue to improve airframe, engine, and aircraft subsystems so that the F-16 can counter the increased Soviet quantitative and qualitative threat. Fiscal Year 1986 development activities include production incorporation of AMRAAM capability

and robust electronic warfare countermeasures provisions. We are also developing a digital flight control system to provide, in conjunction with LANTIRN, a night, under-the-weather mission capability. Our Fiscal Year 1987 program will continue development efforts on radar Electronic Counter-Countermeasures. We are developing a retrofit kit for early model F-16 A/Bs to allow employment of new weapons such as AMRAAM and to baseline a common configuration with our European partners.

Our Fiscal Year 1987 request funds 216 F-16 C/D aircraft during the second year of the F-16 follow-on multiyear contract. The original multiyear contract saved $257 million. We expect to realize greater savings as a result of the second multiyear contract.

6. Advanced Tactical Fighter

a. MISSION: To meet the threats of the 1990's, we are developing the air superiority fighter of the future, the Advanced Tactical Fighter (ATF). This aircraft will counter the next generation of Soviet fighters that will have maneuvering capability and fire control systems vastly superior to most advanced F-15 and F-16s. The possibility of operations in areas such as Southwest Asia demand an aircraft with greater combat radius, more rapid deployment capability, a low observable signature, and reduced logistics support than our present fighters. Through the application of signature control, supersonic cruise and maneuver, and advanced avionics, the ATF will provide a dramatic increase in lethality, survivability and offense capability to ensure air superiority after the mid-1990s.

***ONE POSSIBLE TYPE OF ADVANCED TACTICAL FIGHTER***
***Artist's Concept***

b. STATUS: We are proceeding toward the selection of three or four contractor teams who will demonstrate/validate the respective ATF concepts through detailed design analysis, mission effectiveness testing, and wind tunnel testing. The Request for Proposal was released on October 8, 1985. The RFP sets a

design-to-cost goal of $35 million (Fiscal Year 1985 $) for the unit flyaway cost. We will also establish design-to-cost goals for unit production cost, annual operation and support costs, and twenty year Life Cycle Costs. We expect the demonstration/validation contractors to plan high levels of competition at subsystem and component piece part levels. We anticipate Milestone I approval in mid-Fiscal Year 1986. The Demonstration/Validation Phase, continuing through Fiscal Year 1989, will place heavy emphasis on hardware risk-reduction efforts in key ATF technologies. We expect to select an ATF design and begin full scale development in Fiscal Year 1989. We are driving toward a 1995 Initial Operational Capability.

The engine for this aircraft will have significant capability improvements over current engines. During Fiscal Year 1985, we completed the engine design and fabricated critical engine components. In Fiscal Year 1986, we will complete fabrication of demonstration engines and begin durability and performance demonstrations. In Fiscal Year 1987 we will continue durability and performance demonstrations and conduct accelerated mission testing. We plan to have over 800 hours of engine testing prior to transitioning to full scale development in Fiscal Year 1989.

7. Low Altitude Navigation and Targeting Infrared for Night

a. MISSION: Soviet and Warsaw Pact armored forces are becoming stronger. These forces equipped with night vision capability and accurate laser ranging systems assure a continued enemy thrust during night and adverse weather. To counter this threat, we must be able to fight in these conditions. We consider lack of night attack capability to be the most serious operational deficiency in our tactical air forces today. The Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) system opens up the night window and denies the enemy this sanctuary. LANTIRN provides the capability for the F-15E and F-16 C/D to ingress the target area below enemy air defenses at night and in conditions of limited visibility. It also provides the capability to acquire and accurately attack tactical targets with the Imaging Infrared (IR) Maverick, laser-guided bombs, and other conventional ordnance.

b. STATUS: Since we capped its cost in early 1983, the LANTIRN program has been stable and remains on track from a cost standpoint. Eighty percent of the development effort is behind us. We have completed Initial Operational Test & Evaluation (IOT&E) of the navigation pod and the results were excellent. We flew more than 570 sorties and over 100,000 miles under 500 feet with over 50,000 miles at night. Our follow-on testing of the navigation pod Reliability and Maintainability fixes has produced excellent results. Pod reliability now stands at approximately 29 hours, well ahead of the projected 18 hours. The navigation pod is in production with Lot II placed on contract in early 1986. The targeting pod, as we stated last year, did not mature as fast as the navigation pod. During the past year, we have conducted additional testing, and recent test results have been very encouraging. We have corrected the problems noted in earlier testing. Our pilots have noted overall improvement in the Forward Looking Infrared (FLIR) picture and tracker stability. These pilots have been able to "lock on" to vehicle sized targets at six nautical miles (nm) (3-4 nm was expected). The system has also made numerous IIR Maverick missile handoffs. As of January 10, 1986, we have flown the pod on 349 sorties over 60,000 miles, with 20,000 miles at night. We began IOT&E in January 1986. We will make the targeting pod production decision this Spring.



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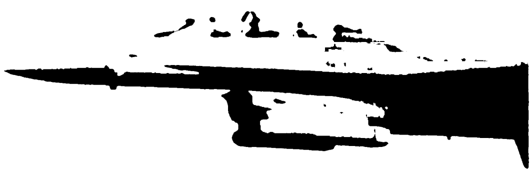


*F-16 WITH LANTIRN PODS*

Both the development and production programs are under firm fixed-price contracts. We have exceptional warranty provisions and stringent reliability requirements. The contractor will repair all failures for up to 24 months or 400 operating hours on all pods at no cost to the government. The production contract is for 700 pod sets and 29 sets of Intermediate level support equipment.

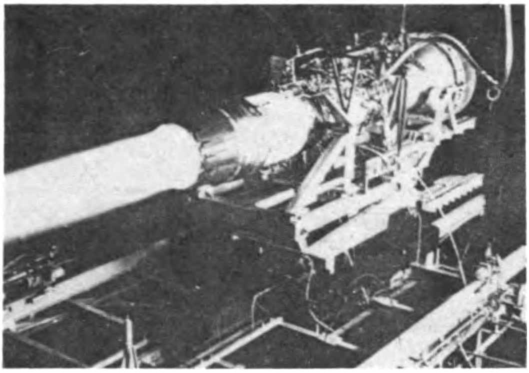
The first navigation pod production delivery is scheduled for April 1987. The first target pod will be delivered in April 1988. Initial Operational Capabilities are 1989 and 1990 respectively.

Our Fiscal Year 1987 research and development request supports F-15E/ LANTIRN and F-16/Auto Terrain Avoidance flight testing and continues support equipment development. Our procurement request will buy 143 navigation pods, seven targeting pods, six sets of support equipment, and spares.

8. Engine Model Derivative Program

a. MISSION: The Engine Model Derivative Program (EMDP) provides air vehicle systems with the latest advances in engine technology and provides a framework for engine development for future systems. It demonstrates derivative engine concepts incorporating new low-moderate risk technology in the areas of performance, durability, operability, supportability, reliability, maintainability, and other engine capabilities, i.e., thrust reversing/thrust vectoring, in prototype engines prior to full scale development. EMDP provides competitive alternate engine candidates for military aircraft.

b. STATUS: Under the EMDP umbrella, we currently have two engine demonstration programs. We are finishing the F100 EMDP test program. The F100 EMDP engine is a 27,000 pound thrust class growth version of the current Pratt and Whitney F100-220 Alternate Fighter Engine (AFE) engine. The higher flow fan and full life low pressure turbine developed for this EMDP engine will be used in the Pratt and Whitney F100 Increased Performance Engine (IPE) design.



***ENGINE TEST FOR THE***
***ENGINE MODEL DERIVATIVE PROGRAM***

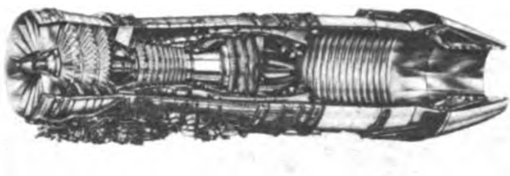
This past summer we began our second demonstration program, the F100/F110 Increased Performance Engine program. This program will yield valuable data which will be used during full scale development. Pratt and Whitney and General Electric have completed the preliminary design reviews for their respective 29,000 pound thrust class derivatives of the F100 and F110 AFE engines. We will begin demonstration engine testing in Fiscal Year 1986. Each demonstration engine will accumulate approximately 4,000 cycles of operation. We will make a Full Scale Development decision for these engines in May 1986. Fiscal Year 1987 will be a transition year, where we will transfer our efforts from these demonstration programs to full scale development under the Alternate Fighter Engine program.

9. Alternate Fighter Engine

a. MISSION: The Alternate Fighter Engine (AFE) program supports the Tactical Fighter Roadmap by providing durable, supportable, and affordable fighter engines for the expanding F-15 and F-16 fighter forces. Program activity also includes configuring engine bays in both aircraft to be capable of receiving either the Pratt & Whitney F100 or the General Electric F110 engines. This program also funds full scale development for the increased performance version of F100 and F110 scheduled for 1990 delivery.

b. STATUS: In Fiscal Year 1986, we will complete the Alternate Fighter Engine development. We began quantity production of both the F100 and F110 engines in January. The first delivery of an F-16 C/D with the General Electric F110 engine is scheduled for July 1986. We also will fabricate development hardware for the F-15 Configured Engine Bay. In May 1986, we expect a full scale development decision for the F100/F110 Increased Performance Engine (IPE) program. This decision will be based on favorable critical design reviews for both engines. In Fiscal Year 1987, we will assemble FSD and flight test engines. We will also begin sea level engine testing and flight testing of pre-production prototype

engines. In the coming years, we will put each engine through over 1000 hours of ground testing and a 4000 Total Accumulated Cycles accelerated mission test. If all goes according to plan we would expect to deliver the first production IPE engine in January 1990.



*GENERAL ELECTRIC F110 AFE*

*PRATT & WHITNEY F100 AFE*

10. INEWS/ICNIA INTEGRATED AVIONICS

a. MISSION: Since World War II new electronic systems have been added piecemeal to our combat aircraft -- as individual stand alone avionics systems. With the increasing reliance upon more sophisticated and complex avionics systems to assist the pilot in accomplishing his mission, the costs of developing and integrating individual systems into aircraft one at a time have become prohibitive. The Integrated Electronic Warfare System (INEWS) and the Integrated Communications, Navigation, Identification Avionics (ICNIA) system are making major changes to the way we add new capabilities to our avionics suites. These systems will be made up of hardware and software modules which can be put together in various combinations to tailor the operational capability to the mission of the particular aircraft type.

b. STATUS: The INEWS is now finished concept definition and source selection is currently underway to pare down the five different contractor team's concepts to the two best concepts. These two will enter the demonstration/validation phase in May 1986. The ICNIA contractors have completed critical design review, and are now constructing hardware and coding software for their competing designs. Delivery of the first advanced development model ICNIA radio is scheduled for December 1987.

INEWS continues as a joint Air Force/Navy program targeted for the Advanced Tactical Fighter (ATF) and Advanced Tactical Aircraft (ATA). The Navy has joined the Air Force and Army in the ICNIA program, adding the ATA, F-14D, and F/A-18 to the ATF, F-16, F-15, and LHX as potential users of the system.

## C. Munitions Acquisition

### BACKGROUND

1. Rationale: The Soviets continue to maintain a large well-equipped ground force. This offensively oriented force capable of large scale, theater wide combined arms operations posses a serious threat to the NATO alliance. The Soviets are posturing themselves to be able to achieve their goal of attaining a quick victory in theater warfare through the rapid advance to deep theater objectives. We must be able to counter any attack with conventional forces.

2. Threat: The Soviets have 213 maneuver divisions with an extensive support structure, including artillery, missile, air defense, engineer, reconnaissance, signal, chemical, and logistics units. Tank and motorized rifle and airborne divisions constitute their basic maneuver forces. This force is continuing to grow and be modernized continually. The Soviets are also expanding and upgrading their support structure. Their goal is the concentration of overwhelming firepower to achieve advantageous force ratios.

3. Munitions Acquisition Plan: Sophisticated Soviet and Warsaw Pact defenses make overflight of high value targets increasingly hazardous. Warsaw Pact numerical superiority in armored vehicles dictate multiple-kills-per-pass weapons. Soviet numerical air superiority drives us toward launch and maneuver air-to-air weapons. Obviously there are situations that do not require such sophisticated weaponry, nor are we able to buy all the precision guided munitions we require. A plan was developed, therefore, to help us determine the optimum mix of conventional air delivered munitions. Just as the Tactical Fighter Roadmap

guides our force structure development, the Munitions Acquisition Plan (MAP) guides our air-delivered munitions development and procurement. The MAP addresses our near term shortfalls and represents the Air Force position on what weapons should be procured. The MAP presents a listing of our research, procurement, and advanced development efforts in priority sequence. This listing is useful particularly in situations involving severe financial constraints. The President's budget reflects the conclusions of the MAP.

## Fiscal Year 1987 PROGRAMS

4. Advanced Medium Range Air-to-Air Missile

a. MISSION: The Advanced Medium Range Air-to-Air Missile (AMRAAM) is a high performance launch and maneuver air-to-air missile which will help the U.S. and NATO tactical air forces compensate for the numerical advantage enjoyed by the Warsaw Pact. The AMRAAM is an all-aspect, all-weather, all-environment air-to-air missile for air superiority and air defense aircraft. This follow-on to the AIM-7 Sparrow has significantly improved operational utility and combat effectiveness. The missile provides the attacking aircraft with the capability for multiple target attack during a single intercept. We will deploy the AMRAAM on the USAF F-15 and F-16, and the Navy F-14 and F/A-18. The AMRAAM is one of a family of missiles covered under the Four Power Memorandum of Understanding (MOU) with the US, United Kingdom, the Federal Republic of Germany and France (observer status). Under the agreement, we will develop AMRAAM for use by all participants. AMRAAM will satisfy the NATO operational objective for air-to-air missiles for the 1980's and beyond and will be compatible with the German F-4F and the United Kingdom's air defense version Tornado and Sea Harrier. The United Kingdom, West Germany, and Norway are developing the Advanced Short-Range Air-to-Air Missile (ASRAAM) which is a follow-on to the AIM-9 Sidewinder. Under the provisions of the MOU, we have agreed to mutual data sharing and technology transfer, along with the right to purchase, co-assemble, or dual-produce one another's missile system.

b. STATUS: On December 7, 1984, we began the Development Test and Evaluation (DT&E)/Initial Operational Test & Evaluation (IOT&E) program with the first full scale development AMRAAM (unguided) to verify that the missile meets specification requirements and to make an early operational assessment. We also began the guided test launch program and the Test, Analyze and Fix Program. We have had four successful launches in four attempts since we began the test launch phase. The Defense Systems Acquisition Review Council approved the continuation of the restructured program. Our emphasis in Fiscal Year 1986 is to reduce production costs through producibility enhancements, management initiatives, and by accelerating the follower contractor (Raytheon) to attain earlier competition. The Raytheon production qualification program begins and the producibility enhancement program continues in Fiscal Year 1986. In Fiscal Year 1987, we plan to begin a low rate initial production run of 260 missiles with both contractors. We plan a full competition for production by Lot III (95% of the total projected procurement will be under competition). This competitive procurement coupled with the producibility enhancements will allow for production of the 17,000 missiles within the $5.3 billion (Fiscal Year 1984 $) cost cap established by Congress. In Fiscal Year 1988 we also will complete the F-15 and F-16 DT&E/IOT&E program as well as the F-16 Captive Carry Reliability Program.

*F-16 WITH AMRAAM*

5. Advanced Short-Range Air-to-Air Missile

a. MISSION: The Advanced Short Range Air-to-Air Missile (ASRAAM) is planned to be the next generation short range air-to-air missile. ASRAAM equipped aircraft will be able to outshoot threat aircraft equipped with AIM-9L/M Sidewinder-equivalent weapons. The ASRAAM is optimized for close-in combat where all-aspect, high velocity, high maneuverability, off-boresight capability, and seeker acquisition and tracking are critical performance requirements. As mentioned above, the European governments are developing ASRAAM. This cooperative effort will avoid duplicating development costs, provide options for coproduction and increase NATO standardization and interoperability.

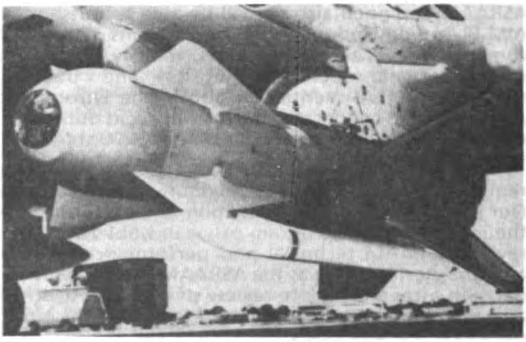
b. STATUS: The ASRAAM program is a new start. We will use the requested funds to provide a continuous liaison during the development effort. Our program office will be at Eglin AFB in Florida. We will have representatives in the joint European program office in Koblenz, Germany. Our representatives will review ASRAAM technical and performance data and assess the impact on our aircrafts' performance as the ASRAAM design evolves. We will make a procurement decision after a complete review of missile cost, schedule, performance, reliability, and maintainability. Assuming a favorable decision, we could expect production missiles in the mid-1990s.

6. Surface Defense Suppression

a. MISSION: In this program, we are developing a family of modular guided weapons designed to destroy high value point targets and enemy defense sites. The GBU-15 is a glide bomb equipped with a television (TV) or Imaging Infrared (IIR) seeker. The AGM-130, a rocket powered GBU-15, is a highly accurate, medium-standoff weapon. Both weapons provide low altitude launch capability with high terminal accuracy through man-in-the-loop weapon control from launch to impact. The AGM-130 responds to the improving enemy air defense systems by allowing the attacking aircraft to move further from the target. These weapons employ the same seekers and data link. For hard target attack capability, we plan to integrate the Improved-2000 pound warhead into the AGM-130. The

GBU-15 family will be deployed with F-4E and F-111F aircraft. The AGM-130 will be carried by the F-15E in addition to the F-4E and F-111F.

*GBU-15 ON F-111*



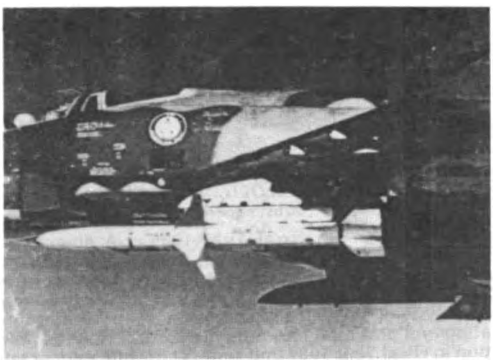
***AGM-130***
***Artist's Concept***

b. STATUS: The GBU-15/TV version is in production. We are conducting Follow On Test and Evaluation on the IIR version. The IIR version will provide us with a night attack capability. The IIR seeker we are using is 90% common with the Maverick IIR seeker. We began AGM-130 development in September 1984. DT&E/IOT&E began in the fourth quarter of Fiscal Year 1985. We are able to reduce the development time because the AGM-130, a Preplanned Product Improvement, makes maximum use of GBU-15 in production hardware. The only major additions are the rocket motor and the radar altimeter. Based on favorable test results during Fiscal Year 1986, we will begin procuring tooling, test equipment, and production-proof AGM-130As. We will also begin full scale development of an improved data link. The data link is key to successful employment and high terminal accuracy for both the GBU-15 and the AGM-130A. In Fiscal Year 1987, we will continue GBU-15/IIR production and make a production

decision on the AGM-130A. We will also continue developing the improved data link. Due to fiscal constraints, we have cancelled further efforts on the AGM-130B dispenser variant.

7. High Speed Anti-Radiation Missile

a. MISSION: The High Speed Anti-Radiation Missile (HARM) provides a destructive counter to sophisticated enemy ground based, radar guided missiles, and antiaircraft artillery systems which threaten our tactical aircraft survivability. The F-4G Wild Weasel equipped with the HARM represents our only dedicated lethal defense suppression weapon system. The HARM is a joint service effort with the Navy as the executive service.



*F-4G CARRYING HARM*

b. STATUS: We have been taking delivery of HARM missiles since December 1983. We achieved Initial Operational Capability in September 1984, at George AFB, California. We are requesting funds to procure 2130 missiles in Fiscal Year 1987. Our research and development request will be used to keep the HARM abreast of the threat. We plan software updates to improve performance against new radars. We are also planning hardware upgrades to reduce future hardware costs and improve HARM availability to the user. We anticipate concluding the product update program in Fiscal Year 1988. In addition, the joint Navy/Air Force Lower Cost Seeker program is proceeding in accordance with Congressional directives.

8. Hypervelocity Missile

a. MISSION: The Hypervelocity Missile (HVM) is a small, fast, low-cost, laser-guided munition which can achieve multiple-vehicle kills on a single pass. The HVM concept promises to give the U.S. an impressive increase in firepower for the anti-vehicular mission at an equally impressive decrease in cost per target destroyed. The HVM is a 5000 feet per second, 66 pound, low cost ($8.5 thousand) class missile for use against all vehicles, including armor. This advanced technology

development program is a tri-service effort which maximizes component commonality.

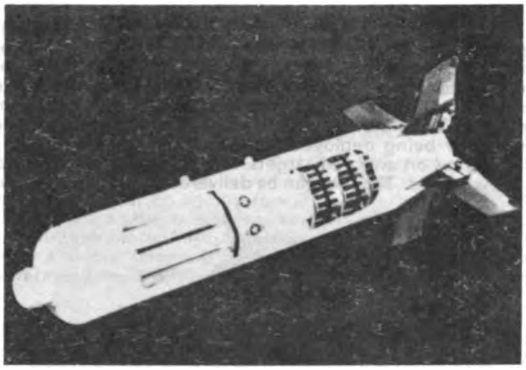
***F-16s ATTACKING TANKS WITH HYPERVELOCITY MISSILES***
***Artist's Concept***

b. STATUS: In Fiscal Year 1985, we amended the Air Force contract to include Army and Marine Corps requirements. We began missile component design. In Fiscal Year 1986, we will continue contractor design of missiles, launchers, and test equipment. We will also begin integration of the current fire control system. We will also conduct a weaponization study addressing aircraft integration and potential alternate fire control systems. We will complete missile fabrication in Fiscal Year 1987 and conduct ground and air launched testing. We expect to proceed into full scale development in Fiscal Year 1989.

9. Armament Ordnance Development

a. MISSION: In this program, we conduct our primary activities for modernizing and developing unguided air-to-surface conventional munitions, and associated carriage, release and handling equipment. Our efforts provide new capabilities to fill operational voids and modernize existing capabilities to eliminate deficiencies. Presently our major focus is the development of the Direct Airfield Attack Combined Munition (DAACM). DAACM is a Tactical Munitions Dispenser (TMD) containing eight Boosted Kinetic Energy Penetrators (BKEP) and 24 British HB-876 mines. DAACM will significantly improve our airfield attack capability and will be the successor to the currently procured French Durandal. The BKEPs provide multiple craters per weapon and the mines impede runway and taxiway repair operations as well as threaten aircraft.

b. STATUS: DAACM development (integration of BKEP and mines into the TMD) begins in 1986 with a source selection and contract award. In Fiscal Year 1987, we will conduct a critical design review, begin flight tests, and conduct a production readiness review. We will complete DT&E and IOT&E and make a Low Rate Initial Production decision in Fiscal Year 1989.



*DIRECT AIRFIELD ATTACK COMBINED MUNITION*

We are also developing the Transportable Missile Storage Rack, the Reusable Protective Device, the Improved 2000 pound (I-2000) warhead, and several warhead fuzes. The Transportable Missile Storage Rack and the Reusable Protective Device will be in source selection during Fiscal Year 1987. The Transportable Missile Storage Rack will allow high density storage and intra-theater air transportation of missiles. The Reusable Protective Device will allow us to place preassembled munitions in long-term storage protected from the elements. In Fiscal Year 1986, we will make a production decision on the I-2000 warhead.

10. Hardened Target Munition

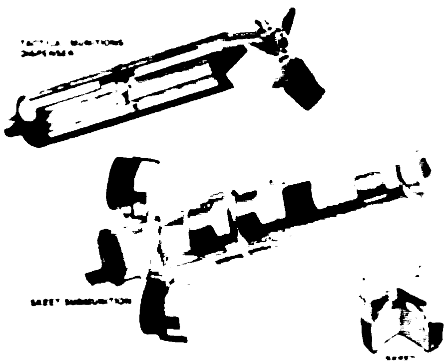
a. MISSION: The Hardened Target Munitions program will develop two new weapons for use against the expanding array of hard targets. The I-1000 will be a 1000-pound penetrating warhead with operational carriage and delivery flexibility beyond that of the I-2000 warhead. It is being developed for use with developmental standoff weapons. The boosted penetrator will provide capability beyond that available with the I-1000 and I-2000. This program will also continue to improve the I-2000. Improved fuzes and better targets to test penetrating weapons will be developed to support the development of these new weapons.

b. STATUS: This is a Fiscal Year 1987 new start. We consider the I-1000 a low risk development effort since it utilizes existing penetration technology demonstrated in the I-2000 program. We will award a development contract early in the year. We will begin wind tunnel and sled testing by the fourth quarter. In Fiscal Year 1988, we will begin DT&E/IOT&E and environmental/safety qualification testing. We expect to complete DT&E/IOT&E in November 1989 and make a production decision and contract award shortly after. The boosted penetrator will be a higher risk program. We are planning to conduct a free flight demonstration of the technology at the beginning of the full scale development program in Fiscal Year 1989.

11. Sensor Fuzed Weapon

a. MISSION: The Sensor Fuzed Weapon (SFW) will provide the capability to destroy multiple enemy tanks during a single pass. The SFW can be

employed during night and adverse weather conditions permitting us to overcome the large numerical armor advantage of the Warsaw Pact. The 1000-pound Sensor Fuzed Weapon is a Tactical Munitions Dispenser (TMD) packaged with ten Skeet Delivery Vehicles each with four armor defeating warhead mechanisms. This mechanism is commonly called a Skeet. It consists of a self-forging warhead and an infrared detector. After being deployed from the delivery vehicle, the infrared detector locates hot areas on armored targets. When the hot spot is located, the mechanism fires the warhead. The SFW can be delivered from low altitudes.



*SENSOR FUZED WEAPON*

b. STATUS: In late Fiscal Year 1985, we successfully completed a risk reduction program for the Sensor Fuzed Weapon. The risk reduction effort addressed a fratricide problem that appeared during early testing. This fratricide effect was seen when the blast from the first warhead caused a second warhead to detonate. We believe we have solved this problem. The reduction program ended successfully with a full function test of a Skeet Delivery Vehicle. The delivery vehicle successfully ejected a full load of four Skeets. Each Skeet detected a separate tank target and fired its warhead which struck the target. We began full scale development in November 1985. A Critical Design Review is scheduled for July 1987. We will begin DT&E/IOT&E in Fiscal Year 1987 and will make a production decision in October 1988.

## D. Battlefield Management

### BACKGROUND

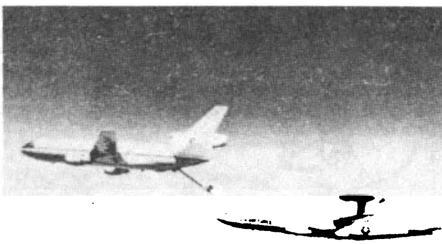
1. Rationale: It is not enough to provide a field commander aircraft and munitions. We must give him the capability to manage his forces in the prosecution of the battle. He needs eyes and ears to penetrate the "fog of war" to locate and target, ideally in real-time, enemy defenses, troop concentrations, and armored columns. He needs secure communications systems to pass time-critical data to command and control centers and friendly forces. He needs reliable, long-range methods for his ground and air forces to identify friend from foe. These capabilities are critical if he is to be able to adjust the order of battle, establish target priorities, and make effective use of our limited defense suppression and tactical jamming

assets. The Fiscal Year 1987 President's Budget provides a balanced program which responds to the threat and the field commanders needs consistent with our budgetary constraints.

## Fiscal Year 1987 Programs

2. E-3 Airborne Warning and Control System

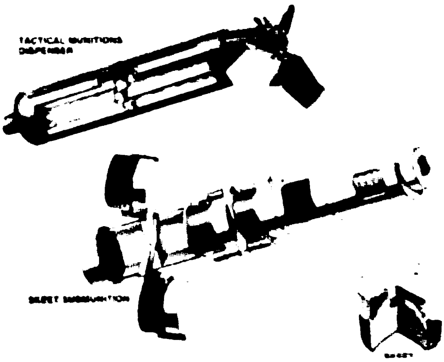
a. MISSION: The E-3 Airborne Warning and Control System (AWACS) overcomes ground based surveillance system deficiencies such as range, vulnerability, and effectiveness against low altitude targets. The AWACS provides real time management of the air battle in support of tactical air operations and in defense of the continental United States. Our ongoing program strives to maintain the AWACS as a viable system through command and control and electronic counter-countermeasures (ECCM) improvements.



*KC-10 REFUELING E-3 AIRCRAFT*

b. STATUS: In Fiscal Year 1985 we completed flight-test activities to place additional radios and multipurpose consoles on the aircraft. The communications electronic countermeasures (HAVE QUICK A-Net) improvement project will continue through Fiscal Year 1986 and complete development in early Fiscal Year 1988. During 1986 we will begin, with NATO, a cooperative development of an electronic support measures (ESM) addition to the U.S. and NATO E-3 Surveillance Systems. This addition will provide a passive detection, location, and identification capability against airborne, shipborne, and ground-based emitters. Development of this capability continues through 1989. Another major developmental activity underway is the development of the Joint Tactical Information Distribution System (JTIDS) Tactical Data Information Link "J" (TADIL J). TADIL J will provide secure jam-resistant communications with JTIDS equipped fighter aircraft. This development continues through Fiscal Year 1989. In Fiscal Year 1987 we will begin full scale development of the Improved Radar Data Correlator and improved Radar Control and Maintenance Console. These

employed during night and adverse weather conditions permitting us to overcome the large numerical armor advantage of the Warsaw Pact. The 1000-pound Sensor Fuzed Weapon is a Tactical Munitions Dispenser (TMD) packaged with ten Skeet Delivery Vehicles each with four armor defeating warhead mechanisms. This mechanism is commonly called a Skeet. It consists of a self-forging warhead and an infrared detector. After being deployed from the delivery vehicle, the infrared detector locates hot areas on armored targets. When the hot spot is located, the mechanism fires the warhead. The SFW can be delivered from low altitudes.



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## D. Battlefield Management

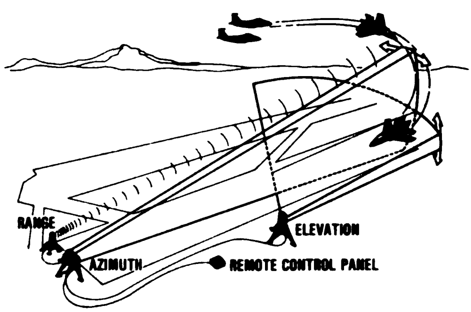
### BACKGROUND

1. Rationale: It is not enough to provide a field commander aircraft and munitions. We must give him the capability to manage his forces in the prosecution of the battle. He needs eyes and ears to penetrate the "fog of war" to locate and target, ideally in real-time, enemy defenses, troop concentrations, and armored columns. He needs secure communications systems to pass time-critical data to command and control centers and friendly forces. He needs reliable, long-range methods for his ground and air forces to identify friend from foe. These capabilities are critical if he is to be able to adjust the order of battle, establish target priorities, and make effective use of our limited defense suppression and tactical jamming

concepts will be evaluated in conjunction with the Navy reconnaissance efforts. A full-scale development decision will be made in Fiscal Year 1989.

14. Traffic Control and Landing Systems

a. MISSION: The Traffic Control and Landing Systems (TRACALS) program provides the Air Force with the air traffic control and landing equipment required for safe, efficient, worldwide, all weather flying operations. The mission need is to provide take-off, enroute, and landing guidance and surveillance in order to meet wartime sortie requirements. In peacetime, the need is to support training, logistics, and other operational flying with maximum safety.




*TRAFFIC CONTROL AND LANDING SYSTEMS*

b. STATUS: The U.S. has agreed to adopt the international standard Microwave Landing Systems (MLS) in place of our existing Precision Approach Radars and Instrument Landing Systems. In Fiscal Year 1987, TRACALS plans to develop a Mobile MLS; update of the air traffic control surveillance equipment to make our fixed base systems survivable in combat. A new Mobile Radar is being planned for replacement of 1950 vintage systems. Existing Marine Air Traffic Control and Landing Systems development will be used where possible.

## E. Defense Suppression and Electronic Combat

## BACKGROUND

1. Rationale: Increasingly complex high technology weapon systems are appearing on both sides of the modern battlefield. Many of these systems make use of some portion of the electro-magnetic spectrum. In addition to radio, and radar and infrared subsystems, new systems make use of optical, electro-optical, ultraviolet and laser technology. For our forces to operate effectively, they must have clear access to these portions of the electro-magnetic spectrum. At the same time, they must have the capability to deny enemy forces use of this spectrum by exploiting their electro-magnetic vulnerabilities. This exploitation can take the form of destruction or deceptive measures or self-protection techniques such as chaff, flares, radar warning, and jamming systems, application of radar absorbent material, or employment factors.

2. Threat: The Soviet Union has the most comprehensive air defense system in the world. In the European theater alone the Soviets have concentrated over 10,000 surface-to-air missile (SAM) launchers and antiaircraft artillery (AAA) pieces. One of their newest weapons, the SA-11, features an on-board radar, increased mobility, and increased target handling capability. The Soviet SA-X-12 will be able to counter high performance aircraft and will also have capability against tactical ballistic missiles. This air defense system provides broad coverage for all altitude defense in all weather conditions. In addition, the Soviets are developing their MAINSTAY AWACS program. This aircraft will substantially increase the Soviet early warning and command and control capabilities. Soviet research and development continues to develop well designed, technically advanced air defense and Command, Control and Communications systems. It is these improvements in surveillance, identification and target tracking capabilities that our efforts are designed to over come.

3. Current Systems: Our current assets include the highly effective F-4G Wild Weasel/HARM weapon system, the EC-130 Compass Call aircraft, the EF-111 Tactical Jamming System and a variety of Electronic Countermeasures pods and chaff and flare dispensing systems.

4. Future Systems: Our thrust is to provide updated or new capabilities to our aircraft already in service. We are updating the F-4G Wild Weasel and EF-111 Raven systems to permit them to operate effectively into the 1990s. For our fighter aircraft we are updating our present jamming pods, flare dispensers, and radar warning systems. We are developing new capabilities such as the internal Airborne Self-Protection Jammer for the F-16. We are also studying our future Suppression of Enemy Air Defense needs.

## Fiscal Year 1987 Programs

5. F-4G Wild Weasel

a. MISSION: The F-4G Wild Weasel can autonomously detect, identify, locate, engage, and destroy hostile radars. The F-4G Wild Weasel can be employed in a counter-air role as a penetration strike force escort, as an independent hunter-killer force, or as a standoff defense suppression force. We are updating the Wild Weasel systems so that the force can defeat the advanced threat radars being deployed now and through the 1990s. The APR-38 Radar Warning and Attack System is the backbone of the F-4G Wild Weasel. To update this mid-1970's design, we are increasing the capacity of the on-board computer, increasing receiver frequency range, and increasing system processing speed. These updates will allow the Wild Weasel aircraft to defeat increasingly complex radar signals in a denser signal environment. With these updates, we will also be able to fully exploit the capabilities of the High Speed Anti-Radiation Missile (HARM).

b. STATUS: Phase I of the update (increased computer capacity) began DOT&E/IOT&E in April 1985. Results look good and we expect to make a production decision in March 1986. We will begin deliveries and field installation of the phase I computers in Fiscal Year 1987 with an Initial Operational Capability (IOC) planned for September 1987. We completed circuit design feasibility of all critical components for Phase II (new receiver for increased frequency coverage and capability in a denser signal environment) and started fabricating the prototype units. Phase II was delayed due to vendor problems and receiver design miniaturization efforts. In Fiscal Year 1986, we will conduct receiver group airworthiness qualification and reliability testing, low frequency synthesizer airworthiness qualification, and complete software programming in preparation

for flight test. We begin Phase II DT&E/IOT&E in July 1987 with testing continuing into Fiscal Year 1988. We will procure Phase II equipment beginning in Fiscal Year 1988 with IOC occurring in Fiscal Year 1990.

*F-4G WILD WEASEL*

In the Wild Weasel request, we have also included funds to conduct concept evaluation/risk reduction efforts in support of a follow-on Wild Weasel. This effort will determine the optimum approach to accomplishing the Suppression of Enemy Air Defense mission in the future.

6. EF-111 Tactical Jamming System Update

a. MISSION: The EF-111 Raven provides tactical jamming of early warning, acquisition, and ground control intercept radars in support of United States and Allied tactical strike operations. The EF-111 Tactical Jamming System denies enemy command and control centers the necessary range, azimuth, and altitude information used to cue their interceptors, surface-to-air missiles and antiaircraft artillery. The Raven can either accompany the strike force or act as a standoff jammer.

b. STATUS: The present EF-111 jamming suite was baselined in 1974. The update to counter Soviet advances since then will incorporate a new encoder, a new computer, a MIL-STD-1553B data bus, two reprogrammable exciters, and a new band 7/8 antenna. We are also making software changes to improve management of system power to concentrate the jamming signal on the radars of interest. Our update efforts are being closely coordinated with the Navy so that our efforts and their efforts to update the EA-6B jamming suite are not duplicative and provide synergistic results for both programs. In October 1984 we awarded a firm fixed price development contract with prepriced production options. In Fiscal Year 1986 we will fabricate full scale development kits and integrate them into test aircraft. The first kit delivery will be in May. We will also begin DT&E/IOT&E which will be completed in Fiscal Year 1987. We expect to make a production decision in Fiscal Year 1988.

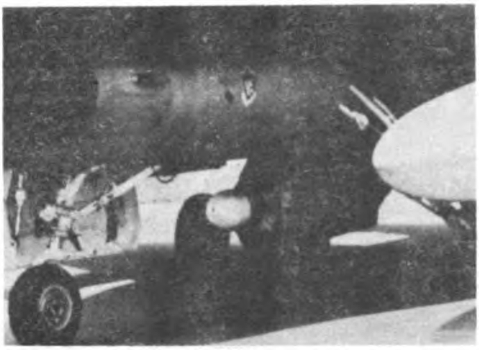
*EF-111 RAVEN*

7. Electronic Countermeasures Pods

a. MISSION: Electronic Countermeasures (ECM) pods provide a self protection capability for tactical aircraft which because of space, power, or cooling limitations or prohibitive retrofit costs, lack an internal countermeasures system. These aircraft include the A-7, the A-10, the F-16A/B/D, and the F-4. Our current inventory of pods includes ALQ-131 Block I & II pods, ALQ-119 pods (and the upgraded ALQ-119 pods). Continuous advances in Soviet air defense capabilities force us to upgrade/replace our inventory. By equipping tactical aircraft with these pods we can enhance their survivability. We also then will be able to use our limited, dedicated jamming asset, the EF-111 Raven, more efficiently.

b. STATUS: We are acquiring the ALQ-131 pods with improved reliability, maintainability, and performance. This pod gives the F-16A (and F-16C aircraft until the Airborne Self Protection Jammer (ASPJ) is available) a self-protection capability. During Fiscal Year 1985 we pursued Very High Speed Integrated Circuits technology applications in ALQ-131 components which were in various design stages.

During Fiscal Year 1986, we will begin Qualification Test and Evaluation of an upgraded ALQ-119 pod. We are currently accepting delivery of the first 70 systems. These modification kits are installed by both contractor and Air Force depot personnel. We will begin Qualification Operational Test and Evaluation in Fiscal Year 1986.



*ALQ-131 POD MOUNTED ON F-16*

8. Protective Systems

a. MISSION: This program develops new and improved self-protection equipment for Air Force strategic and F/FB-111 aircraft. This equipment includes infrared, optical, and electronic countermeasures and improved dispenser systems. This program maintains and updates computer threat simulation programs for evaluation of electronic warfare equipment. Funds are also used to keep our antenna test ranges current. We will concentrate on the F/FB-111 related activity.

b. STATUS: We are upgrading the F/FB/EF-111 aircraft countermeasures system for accurate and optimum use of chaff and flares. We are also developing an improved tail warning system for accurate detection of air-to-air and surface-to-air missiles. We plan to complete full scale development and make a production decision on the ALE-40 dispenser in Fiscal Year 1986. We should begin flight testing in Fiscal Year 1987.

9. Tactical Protective Systems

a. MISSION: This program develops new and improved self-protection electronic warfare equipment for tactical strike, air superiority, airlift and reconnaissance aircraft. We are currently working on systems for the F-15, F-16, A-10, F-4, special operations and airlift aircraft. These updates will provide effective aircrew warning and countermeasures to protect against sophisticated airborne and surface-to-air threats.

b. STATUS: For the F-15 aircraft we are upgrading its self-protection suite, the Tactical Electronic Warfare System (TEWS). The TEWS includes a radar warning receiver (ALR-56), an internal countermeasures system, an electronic warfare warning system, and a countermeasures dispenser. During Fiscal Year 1985, we conducted ground testing and developmental flight testing of individual systems and began TEWS integration. Since November 1984, production line F-15 C/D aircraft are equipped with Group A provisions for the ALE-45 Countermeasures Dispenser (CMD), ALR-56C and ALQ-135. In Fiscal Year 1986, we

will begin full-up hardware/software development integration and testing. In Fiscal Year 1987, we will complete IOT&E of the TEWS and make a low-rate initial production decision. We also expect to deliver the prototype TEWS intermediate level support system.

For the F-16, we are developing a threat adaptive countermeasures dispenser, the ALE-47. In addition to being reprogrammable, the ALE-47 CMD interacts with the aircraft's Radar Warning and Jamming Systems. The interaction of these systems provides improved protection for the aircraft. We fielded two competing prototype ALE-47 C MDs. During Fiscal Year 1987, we will begin F-16/ ALE-47 CMD integration. In Fiscal Year 1989, we plan to conduct DT&E and IOT&E and make a production decision in November 1989. We expect first production deliveries in July 1990. We will begin development of a pyrophoric flare (an expendable countermeasure capable of igniting spontaneously in the air, for use against infrared missiles) sized for the F-16.

For the A-10 self-protection suite, we are tailoring systems designed for other aircraft such as the ALQ-131 pods and the ALE-47 CMD system. Our primary activity is developing a pyrophoric flare sized for the A-10. We demonstrated the concept's feasibility in Fiscal Year 1985. During Fiscal Year 1986 we will conduct critical design review, ground and flight testing of a prototype flare. We expect to complete development and flight testing by August 1987 and make a production decision shortly thereafter. ALE-47 CMD tailoring should begin in Fiscal Year 1988 and complete in Fiscal Year 1990. Similar types of projects are underway for other fighter and special operations aircraft.

10. Airborne Self Protection Jammer

a. MISSION: The Airborne Self Protection Jammer (ASPJ) (AN/ALQ-165) will increase the survivability of our tactical aircraft (USAF F-16C, Navy F-14, F/A-18, A-6E, AV-8B) when confronted by modern, diversified, radar controlled weapon systems. ASPJ is a joint AF/Navy development program for an internally mounted electronic countermeasures system. The Navy is the lead service. Both services share equally in funding the common development efforts and pay the total costs for each applicable aircraft integration effort.

b. STATUS: In Fiscal Year 1985, we delivered test articles, began reliability demonstration testing, F-16/ASPJ integration and Development Test and Evaluation (DT&E). During Fiscal Year 1986, we will complete necessary milestones so that the production verification decision can be made in July 1986. DT&E will be completed in January 1987 to enable a joint Navy/Air Force Systems Acquisition Review Council (NSARC/AFSARC) limited production decision to be made in February 1987. In Fiscal Year 1987, we will complete environmental and Air Force Electronic Warfare Evaluation Simulator Initial Operational Test & Evaluation testing and begin IOT&E flight tests. We should make our decision for joint, full scale production in March 1988. We plan a total production run of over 2200 systems with over 1200 for Air Force aircraft.

In an effort to further commonality, we are looking at installing ASPJ in systems other than the F-16C. The ASPJ is a candidate in the open competition for the updated Electronic Countermeasures (ECM) system in the F/FB/EF-111 fleet. We are also investigating the advisability of competing a pod version of ASPJ as our next generation ECM pod.

## D. Special Operations Forces

### BACKGROUND

1. Rationale: Special Operations Forces (SOF) must be able to conduct a wide range of missions at all levels of conflict in order to provide the United States with unique options where the use of large conventional forces would be premature, inappropriate, or infeasible. These forces are typically used to resolve crises and to terminate conflicts that are still at relatively low levels. The primary missions for which the Department of Defense maintains a Special Operations Force capability include military/paramilitary training, interdiction raids, personnel recovery, counter-terrorist operations. and, only rarely, covert activities.

Air Force SOF primarily provide airlift and selective firepower support for Army Special Forces, Army Rangers, and Naval Special Warfare Units, and in conjunction with those forces conduct or support collective security, unconventional warfare, direct action/ strike missions, psychological operations (PSYOPS) and contingency missions. Since most SOF missions require secrecy, surprise, and low probability of detection or interception, Air Force SOF assets must be comprised of equipment and personnel specially configured and trained to conduct unusual, short-notice, politically sensitive, low visibility, and difficult to detect operations.

2. Threat: The Soviet Union and its surrogates have both encouraged and supported worldwide revolutions as a way of achieving their objectives without direct confrontation with the Free World. These low intensity conflicts will likely be the most pervasive threat to Free World security for the remainder of this century. US Special Operations Forces provide the capability to respond to this threat and a wide range of crises in a flexible manner.

3. Current Systems: Although most aerospace forces may be used in special operations, the Air Force organizes, trains and equips specific units to conduct special operations as their primary mission. These units are equipped with MC-130, AC-130, EC-130, HH-53, and CH-3 aircraft. We organize,train, and employ these forces to provide flexible, specialized capabilities throughout the spectrum of conflict. Selected C-130 and C-141 airlift forces are also specially trained and equipped to augment the core SOF. Combat rescue forces, equipped with HC-130, UH-60, HH-53, H-3 and H-1 aircraft, also augment the SOF.

4. Future Systems: In order to upgrade the current SOF capability the Air Force is procuring additional MC-130s and AC-130s, and is participating with the US Navy in development of the V-22 (JVX) aircraft in order to acquire the CV-22A version for SOF missions. Twenty-one new MC-130H Combat Talon II aircraft will supplement the current fleet of 14 MC-130E Combat Talon I aircraft to reduce the long-range infiltration/exfiltration/ resupply shortfall. Twelve new AC-130 gunship aircraft will allow replacement of the aging and increasingly difficult to support A-model gunships and will increase the fleet's deployability and survivability. Eighty new CV-22A will provide a long-range exfiltration capability not currently possessed and will complement the MC-130 inflitration and resupply capability.

## Fiscal Year 1987 PROGRAMS

5. CV-22A (JVX)

a. MISSION: The CV-22A is the linchpin of Air Force Special Operations Forces (SOF) in the 1990s. It is the key development program for obtaining the long-range capability needed to insert and extract SOF teams. The CV-22A bridges the performance gap between conventional helicopters and fixed wing aircraft by combining medium speed cruise efficiency with vertical takeoff and landing. It replaces the HH-53 and blends with the MC-130H to provide the full spectrum of capability required to perform the worldwide SOF mission.

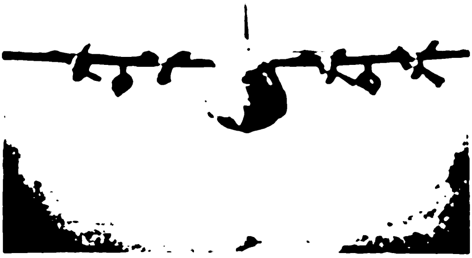
*CV-22A*

b. STATUS: The Navy-led V-22 program has nearly completed the preliminary design phase in which the team of Bell Helicopter and Boeing Vertol conducted over 4500 hours of wind tunnel and simulation testing, completed numerous trade studies to identify cost and weight drivers, and developed cost estimates for full scale development scheduled to begin in early Fiscal Year 1986. The Navy is responsible for funding all airframe and engine developments and their mission unique systems. The Air Force is funding SOF mission unique development and its operational test and evaluation. First flight is set for February 1988 and Air Force deliveries start in Fiscal Year 1993 with initial operational capability (six aircraft) scheduled for Fiscal Year 1994.

6. MC-130H

a. MISSION: The Combat Talon II aircraft will be capable of long-range penetration into politically denied/sensitive, defended areas to infiltrate, resupply, or exfiltrate forces or equipment during adverse weather conditions, day or night. It will conduct low profile operations supporting U.S. or allied services unconventional warfare forces throughout the conflict spectrum from low intensity

conflict to general war. Combat Talon II will perform a broad range of complementary missions using airdrop or airland of personnel and equipment, aerial refueling to extend range and increase surprise, and terrain followina radar to allow terrain masking from enemy threats.



*MC-130H COMBAT TALON II*

b. STATUS: Lockheed is providing C-130H airframes modified with aerial refueling capabability, a high-speed low-level aerial delivery system, explosion and fire suppressed fuel systems, and special lighting equipment. IBM has developed an integrated avionics system to provide terrain following, terrain avoidance radar, precision navigation, secure communications, and electronic counter measures capability. Five aircraft are already on contract funded by Fiscal Year 1982 through Fiscal Year 1985 appropriations. Two aircraft are planned for Fiscal Year 1986. First flight is now scheduled for January 1987, and the initial operational unit will receive the first five aircraft in March 1988 upon completion of the qualification and operational flight test and evaluation.

7. AC-130

a. MISSION: The AC-130 gunship provides Special Operations Forces (SOF) with precision fire support and is a long range attack aircraft with extensive loiter time over the target coupled with an immediate capability to detect, identify, record and destroy targets. Although the gunship's primary mission is special operations/unconventional warfare, its unique capabilities permit the AC-130 to perform the conventional roles of close air support, armed reconnaisance and base defense. The gunship's multimission capability was successfully demostrated during the recent Grenada contingency operation where the AC-130 interdicted key enemy communication sites, destroyed enemy antiaircraft gun positions, provided close air support for the invasion force, and performed around the clock surveillance of the battlefield.

***AC-130***

b. STATUS: The intent of the acquisition program is to allow replacement of the 10 aging and difficult to support AC-130A gunships for 12 new, reliable, and maintainable aircraft. To prepare for a Fiscal Year 1987 new start, the Air Force released a Request For Information (RFI) to industry on October 18, 1985 asking for configuration proposals, cost estimates, and delivery schedules. The Air Force will use the responses to the RFI to draft a Request For Proposal with a target release date of June 1986. The source selection is tentatively scheduled for completion by December 15, 1986 with award of contract before the end of 1986. As in the MC-130H program, the Air Force will procure the C-130 airframes from the Georgia Lockheed Aircraft Corporation and compete the avionics and weapon systems integration. The initial aircraft will be a prototype with testing completed by 1990. Initial deliveries will begin in 1991 with full operational capability in early 1993.

APPENDIX A

# TABLE I

## DEPARTMENT OF THE AIR FORCE
## FISCAL YEAR 1987 AIRCRAFT PROCUREMENT ESTIMATES*
(In Millions of Then Year Dollars)

| | FISCAL YEAR ESTIMATES | | | |
|---|---|---|---|---|
| | 1986 | | 1987 | |
| **COMBAT AIRCRAFT** | QTY | $ | QTY | $ |
| B-1B (MYP) | 48 | 4952.9 | - | - |
| ACM Integration on B-1B | - | 96.0 | - | - |
| Air Defense Competition | 10 | 192.0 | 20 | 410.9 |
| F-15 E | 48† | 1888.9 | 48 | 1894.3 |
| F-16 C/D (MYP) | 180 | 3006.1 | 216 | 3493.9 |
| KC-10A | 12 | 416.4 | 8 | 104.4 |
| AC-130A | 0 | 0 | - | 18.2 |
| MC-130H | 2 | 130.8 | 5 | 244.8 |
| Drug Interdiction | 1 | 33.4 | - | - |
| **COMBAT SUPPORT AIRCRAFT** | | | | |
| C-5B Airlift Aircraft | 16 | 2048.8 | 21 | 1937.4 |
| C-17 | - | - | - | 217.3 |
| C-20A | 8 | 147.7 | - | - |
| Air Force One (VC-X) | 2 | 280.0 | - | 34.5 |
| Civil Air Patrol | 0 | - | 38 | 1.6 |
| TR-1/U-2 | 6 | 296.5 | 3 | 94.5 |
| **MODIFICATION OF IN-SERVICE AIRCRAFT** | - | 2885.3 | - | 3101.3 |
| **AIRCRAFT SPARES AND REPAIR PARTS** | - | 3811.1 | - | 3477.9 |
| **AIRCRAFT SUPPORT EQUIPMENT & FACILITIES** | - | 2844.6 | - | 4096.4 |
| Common Aerospace Ground Equipment | - | 535.5 | - | 321.4 |
| Other Production Charges | - | 2174.0 | - | 3685.5 |
| Industrial Responsiveness | - | 51.9 | - | 38.4 |
| War Consumables | - | 83.2 | - | 51.1 |
| **TOTAL AIR FORCE AIRCRAFT PROCUREMENT** | 333 | 23030.5 | 359 | 19127.4 |

* Based on Fiscal Year 1986 DoD Appropriations and Fiscal Year 1987 President's Budget, as of February 5, 1986.
† Includes 40 F-15 C/D Aircraft.

APPENDIX A

# TABLE II

## DEPARTMENT OF THE AIR FORCE
## FISCAL YEAR 1987 MISSILE PROCUREMENT ESTIMATES*
(In Millions of Then Year Dollars)

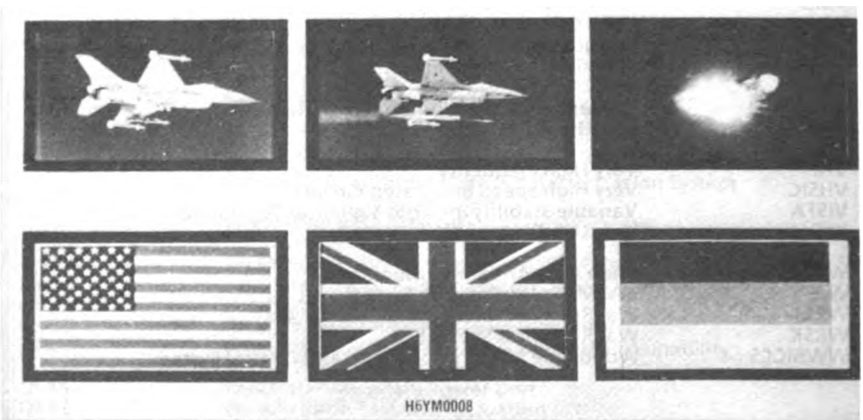
| | FISCAL YEAR | | | |
|---|---|---|---|---|
| | 1986 | | 1987 | |
| **BALLISTIC MISSILES** | QTY | $ | QTY | $ |
| Peacekeeper | 12 | 1676.0 | 21 | 1418.1 |
| Replacement Equipment (Strategic) | - | 63.9 | - | 69.7 |
| **OTHER MISSLES** | | | | |
| Air Launch Cruise Missile | - | 32.6 | - | 12.4 |
| AIM-7M (Sparrow) | 497 | 77.9 | 379 | 64.9 |
| AIM-9M (Sidewinder) | 1650 | 76.9 | 1710 | 95.6 |
| AGM-130 | 5 | 19.0 | 51 | 26.6 |
| AGM-65D/G (Maverick) | 2600 | 407.9 | 4700 | 581.0 |
| AGM-88A (HARM) | 1450 | 414.8 | 2130 | 493.4 |
| AIM-120 (AMRAAM) | 15 | 209.0 | 260 | 746.5 |
| Ground Launched Cruise Missile | 95 | 515.2 | 76 | 133.2 |
| Stinger | - | - | - | 1.7 |
| Target Drones | - | 34.3 | - | 19.6 |
| Other Missile Programs | - | 666.6 | - | 810.2 |
| Industrial Facilities | - | 20.6 | - | 14.5 |
| Replacement Equipment | - | 13.8 | - | 17.2 |
| **MODIFICATION OF IN-SERVICE MISSILES** | | 155.6 | | 146.5 |
| **SPARES AND REPAIR PARTS** | | 441.7 | | 334.2 |
| **SPACE AND OTHER SUPPORT** | | | | |
| Spaceborne Equip (COMSEC) | - | 34.3 | - | 61.9 |
| Global Positioning System (MYP) | 9 | 197.4 | 8 | 129.7 |
| Space Shuttle Operations | - | 240.7 | - | 59.1 |
| Defense Meteorological Sat Prog | - | 41.0 | - | 19.4 |
| Defense Support Program | - | 124.1 | - | 358.5 |
| Defense Satellite Comm System (MYP) | 2 | 141.1 | 2 | 122.7 |
| AF Satellite Communications System | 1 | 32.6 | - | - |
| Space Boosters | - | 120.2 | 1 | 282.7 |
| Space Defense System | - | - | - | 28.5 |
| Special Programs | - | 2717.5 | - | 2896.2 |
| Space Shuttle | - | 21.0 | - | - |
| **TOTAL AIR FORCE MISSILE PROCUREMENT** | | 8317.0 | | 8982.4 |

* Based on Fiscal Year 1986 DoD Appropriations and Fiscal Year 1987 President's Budget, as of February 5, 1986.

## STATEMENT OF BRIG. GEN. TOM FERGUSON, AMRAAM PROJECT OFFICER, DEPARTMENT OF THE AIR FORCE

Dr. Cooper. I would like to introduce Tom Ferguson, who is the manager of the AMRAAM Program. He would like to give you a brief status report on where we are today on AMRAAM. Tom.

General Ferguson. Thank you for the invitation, and members of the committee, it is a pleasure to be able to describe our progress with the program.


May I have the first chart. Of course, we are a joint program, Air Force and Navy. I have Navy personnel located with me in my program office. We will share 24,000 missiles between the two of us. For the first time, we will give the F-16 a beyond visual range capability, and that is illustrated in this sequence of pictures where we successfully downed the drone.

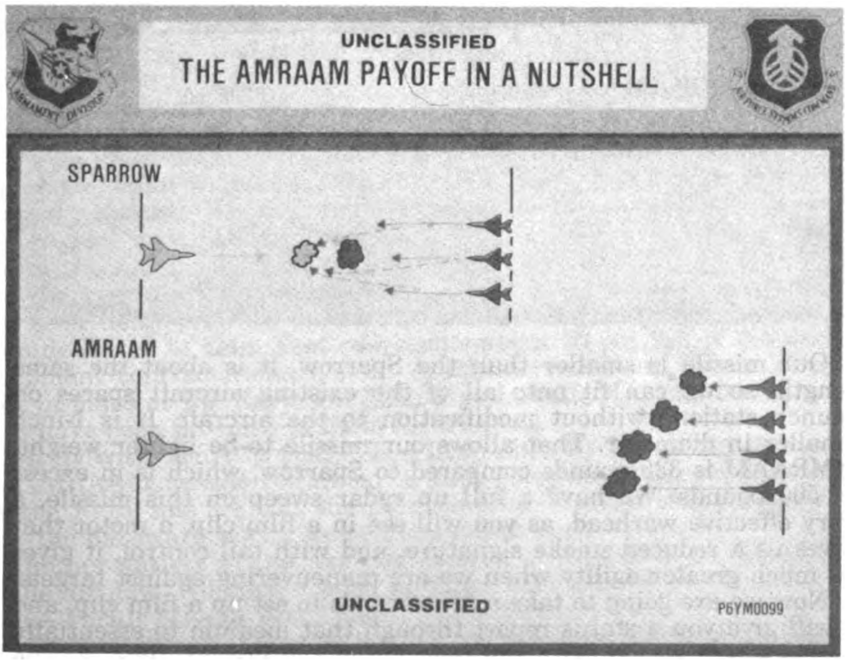
Another important factor is we operate under a family of missiles MOU's with several of our allied countries, United Kingdom and Germany, who, likewise, intend to put this missile on. Of course, we have competition in this program, two contractors, Raytheon and Hughes Aircraft Co.

### A Solid Requirement

Only AMRAAM can satisfy the need for:
A common missile (AF, Navy, NATO).
An all environment capability.
An all-aspect capability.
Autonomous terminal guidance (launch/maneuver)
Simultaneous attack of multiple targets.

Improved aero performance.
Simplified maintenance, logistics, and operational concepts.

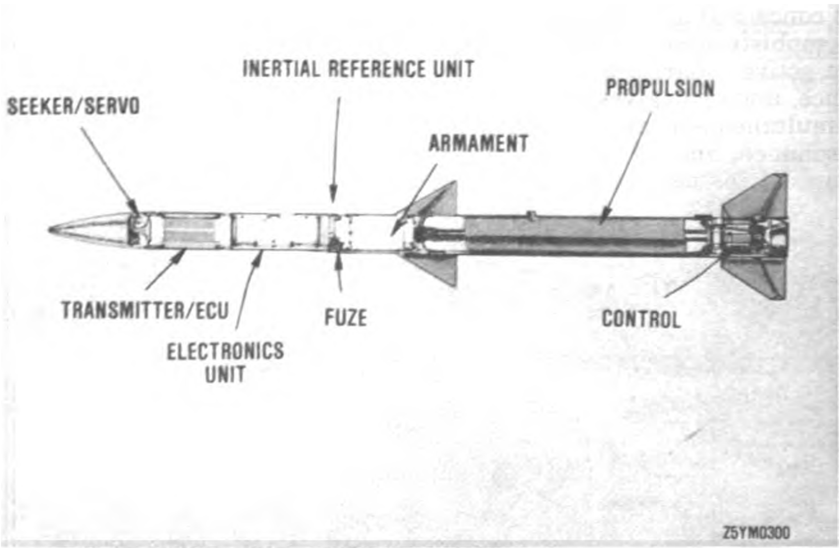
A very brief comment about the missile. First of all, I would like to say it is based upon a solid foundation as far as the requirement is concerned. All weather capability that can handle the threat in a sophisticated electronic warfare environment. Because we have an active radar in this missile, we have autonomous terminal guidance, and that gives us a true launch and maneuver capability to simultaneously attack multiple targets, better aerodynamic performance, and, of course, we are working to simplify our maintenance, logistics and operational concepts.




I have tried to capture really the essence of the capability that AMRAAM brings to our fighter pilots. With today's missile, the Sparrow, as we launch, we must focus on the target. Our radar must continue to illuminate that target as we close in the engagement until our missile destroys the enemy aircraft. Unfortunately, what happens is we close until we become vulnerable to either their medium-range missiles or even their short-range missiles.

Of course, with AMRAAM we avoid that close-in encounter, are able to put multiple missiles into the air simultaneously. Of course, we need that capability to win in the central European environment, and, finally, we have a launch and leave capability.

# AMRAAM




Our missile is smaller than the Sparrow, it is about the same length, so we can fit onto all of the existing aircraft spaces on launch stations without modification to the aircraft. It is 1-inch smaller in diameter. That allows our missile to be lighter weight, AMRAAM is 335 pounds compared to Sparrow, which is in excess of 500 pounds. We have a full up radar sweep on this missile, a very effective warhead, as you will see in a film clip, a motor that gives us a reduced smoke signature, and with tail control, it gives us much greater agility when we are maneuvering against targets.

Now we are going to take a few seconds to set up a film clip, and I will give you a status report through that medium to essentially assess where we are with the program at the present time. At the end of the film clip, I will get to three missile launches, guided launches (a guided missile is one which has the transmitter and receiver included in it.)

I would like to say we had a successful launch last Friday. This is what we called a separation control vehicle. It does not have a transmitter in it, but we were able to demonstrate this missile can pull very high "Gs" in a low altitude, high dynamic pressure environment where we see many of our air battles take place. The missile performs as we anticipated it would, demonstrating the autopilot on the missile does command the control section, and that the airframe responds aerodynamically, as we would have expected.

This status report starts off with some scenes from the warhead being evaluated at Eglin Air Force Base. This is the missile entering the arena. You can see the detonation. We are working against real targets. The warhead weighs just in excess of 40 pounds, as

compared to the one on the Sparrow, which is considerably heavier than that. However, it is a very effective warhead.

In these arena tests we launch against real targets, we will see an aircraft fuselage, as well as wing panels. This is the aircraft—here is the missile coming into the arena. You can see the aircraft fuselage located to the left, and there was no damage on the fuselage prior to the impact, a very representative distance as to what we would expect the actual missile to be as far as miss distance is concerned.

This is a rocket motor, the rocket motor is qualified. The warhead is qualified on the basis of the test. This is a circuit assembly, we call it a chassis, which is one of the building blocks in the missile. The chassis is being tested in an automated test station. We have now built 40 percent of that building block, as we call it, chassis. Thirty-two test stations in our manufacturing facility at Tucson have been approved and are in use. This is an electronics unit, it is the heart of the electronics for the missile. There are eight of those assemblies you have seen.

The entire assembly (the electronics unit) is shown. We have completed about 30 percent of the total requirement for the development program. We tested the electronics unit separately. Once we are sure it works, we integrate it with the balance of the front end of the missile to make up the Seeker, and test that as a unit, and then go to a final assembly and check-out facility, such as the one seen here, prior to delivering the missiles. Twenty-five have been delivered to date. That represents about 20 percent of the development contract requirement. A similar facility to this is also now in place at the Raytheon facility at Lowell, MA, and two missiles have been provided to them for training.

We fly with the ACE pod. It is a little difficult to see, but this is an AMRAAM missile contained in that 500-gallon tank. We fly it on the F-15, and we can simulate air-to-air combat and evaluate how the hardware works, as well as the software.

Another variety of the Ace pod, is seen on this F/A-18. We are in the air now. We have opened up flight operations with the Navy at the Pacific Missile Test Center. Those pods are proving to be excellent tools. Environmental testing: we are now complete on the F-16 pictured here, as well as the F-15. What that tells us is that the missile unit's flight environment has been specified and is performing as we would expect. Here, suitability testing is now complete.

The F-18: you can see the AMRAAM missile located here. Once again, completion of the suitability tests were satisfactory.

We are concerned, of course, about how this missile will perform with the troops in the field. Here you see the missile being loaded out of a shipping and storage container. This upload is being done up onto an F-15, where we uploaded four missiles, two onto a rail and two onto eject stations. We did this exercise in about 22 minutes, which is 1 minute less time than we do currently with Sparrow.

The men who participated in this, of course, have given us some suggestions for ways we can improve the launcher, as well as the hooks on the missile. All of those changes have been designed, and

we get a first-class report from the men who have worked with this hardware.

The first missile launch, notice how cleanly it comes off the wing on the F-16. This was a demonstration. The missile's radar immediately captured the target and passed over the wing tip of the QF-100 drone. If we had a warhead, we believe it would have been a kill.

Our second shot was off the F-15. This one is a look-down-shoot-down shot into severe clutter. You are looking at the F-15 to emphasize the fact we are also accomplishing objectives with the airplane. You will see the missile in real time and you can see how quickly it gets away. The missile launch in the previous sequence was in slow motion.

This is the F-15 in that same launch. You can see how smoothly burning the rocket motor is, which I mentioned is one of our development objectives.

The third guided launch was off of the F-16 again launching, as you can see here, off the rail of the F-16. In this case, we updated the missile's navigation guidance system using the radar from the F-16. We call this a command inertial active shot. The update got the missile to the position where it could turn on its own active radar, acquire the target, and you see the results here, a direct hit. A very successful flight test in all regards on the last mission.

You can stop the film now. I mentioned we got in just last Friday to evaluate the missile's aerodynamic performance in a high G dynamic environment, and it performed precisely as we would expect.

ADVANCED MEDIUM RANGE AIR-TO-AIR MISSILE (AMRAAM) (AIM-120)

($ IN MILLIONS)

| | FY 85 & PRIOR | FY 86 | FY 87 | FY 88 | TO COMPLETE | TOTAL |
|---|---|---|---|---|---|---|
| RDT&E | 819.0 | 101.3 | 39.1 | 13.0 | — | 972.4 |
| WPN SYS PROC | 101.5 | 209.0 | 746.5 | 996.2 | 4812.7 | 6865.9 |
| QUANTITY BUY | — | —* | 260 | 833 | 16,015 | 17,108 |
| DELIVERIES | — | — | — | 88 | 17,020 | 17,108 |

* FOLLOWER QUALIFICATION MISSILES

FY 87 RDT&E REQUEST $ 39.1

| | |
|---|---|
| • FLIGHT TESTING | 12.0 |
| • PSE | 8.3 |
| • A/C CONTRACTOR SUPPORT | 7.8 |
| • OTHER GOVERNMENT SUPPORT | 6.9 |
| • FOLLOWER CONTRACT | 3.6 |
| • SMALL CONTRACTS | .5 |

FY 87 WPN SYS PROC REQUEST $ 746.5

| | |
|---|---|
| • FLYAWAY | 695.2 |
| • ADVANCE BUY (CY) | 89.9 |
| • ADVANCE BUY (PY) | -59.4 |
| • DATA | 8.8 |
| • PSE | 7.3 |
| • TRAINING EQUIP. | 4.7 |

SCHEDULE

| | |
|---|---|
| • FOLLOWER QUALIFICATION | FY 86 |
| • BEGIN LOT I LRIP | FY 87 |
| • IOC | FY 89 |

My last chart talks to the request that we are making of the Congress this year. A couple things that I guess I would emphasize, although not your immediate concern, we are about 95 percent complete right now, as far as development is concerned, on the program from the point of view of expenditures. Only 10 percent of our development funds are still to be spent, and those are to be spent to evaluate the missile, not to do development.

Of course, our procurement request in fiscal year 1987 is for the first production of this missile. It will be shared between the Raytheon Co. and the Hughes Aircraft Co., those 260 missiles. Right now we plan 150 of those to be—or 140 of those to be built by Hughes Aircraft and 120 to be built by Raytheon. We have done everything in our ability to accelerate Raytheon's participation in the program. I believe compared to our original plan, we have accelerated them by at least 1, possibly 2 years.

Everything is going quite well as far as the Raytheon qualification effort is concerned. We are now on contract for them to qualify for building 15 missiles.

That concludes my presentation.

[The GAO missile development report follows:]

THE SECRETARY OF DEFENSE

WASHINGTON THE DISTRICT OF COLUMBIA

K

28 FEB 1986

Honorable Les Aspin
Chairman, Committee on Armed Services
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

As required by the Department of Defense Authorization Act, 1986, Public Law No. 99-145, section 210, the following certification is furnished concerning the AMRAAM weapon system. I hereby certify that:

a. The design of the AMRAAM system has been completed.

b. System performance has not been degraded from the original development specification (DS 32050-000, as amended by the draft Development Concept Paper (DCP) of June 14, 1985).

c. The flight test program has been revised to incorporate the maximum practicable number of selected changes in the design of the AMRAAM system that reduce the costs of the system and that are qualified and flight tested before production.

d. A fixed-price type contract for an amount not more than $556,580,480 has been entered into with the development contractor for research, development, test, and evaluation for such program.

e. The total production cost for the program, for a minimum of 17,000 missiles, will not exceed $5,200,000,000 (in fiscal year 1984 dollars) and that the missiles procured will perform in accordance with the development specification referred to above.

Before making this certification, I have conducted a thorough review of the AMRAAM program. The attachment to this letter provides additional information relating to the certification, that I believe will be of interest to the Committee. Naturally, the Department has developed much other material also in the course of its review, and I will be glad to make this available to the Committee should you wish.

Thank you for the support the Committees have provided for this vitally important defense acquisition effort.

Sincerely,

Caspar W. Weinberger

Attachment

## AMRAAM - ADDITIONAL INFORMATION

a. AMRAAM Design. Critical Design Review (CDR) activities have been completed. During this CDR, the basic design was analyzed by technical experts from the Air Force, Navy, NATO countries, and the second source contractor. The missile is still in development and at this stage of any program design refinements are normal, as is reflected by the third certification (c. below) prescribed by the statute. Design refinements will also occur in production to enhance reliability and producibility.

b. AMRAAM System Performance. Among the data reviewed are flight testing, laboratory environmental qualification testing, simulation, and basic design information.

c. AMRAAM Flight Test Program Revised. The producibility enhancement program plan includes provision for appropriate testing of changes resulting from the producibility enhancement design effort prior to being introduced into the production configuration.

d. AMRAAM RDT&E Contract. It should be noted that such a contract has existed since December 12, 1981.

e. AMRAAM Cost. Congressional funding for AMRAAM in the amounts and on the schedule (for both the Air Force and the Navy) requested by the Administration is essential. The AMRAAM procurement program has always been a joint Air Force/Navy program for 24,000 missiles. The Air Force program is derived based on inclusion of the Navy program of an additional 7,000 missiles for $1.8 billion (in FY 84 dollars) for a total program of $7.0 billion (in FY 84 dollars) for 24,000 Air Force and Navy missiles.

PERCENTAGE UNIT COST REDUCTIONS OF AIR-TO-AIR MISSILES

| PRODUCTION YEAR | PHOENIX | SPARROW (AF+N) | HARM (AF+N) | AMRAAM (AF+N) |
|---|---|---|---|---|
| 1ST YR | 100.0% | 100.0% | 100.0% | 100.0% |
| 2ND YR | 112.9% | 68.4% | 57.1% | 39.2% |
| 3RD YR | 112.5% | 68.4% | 35.8% | 19.5% |
| 4TH YR | 117.7% | 51.1% | 35.4% | 11.9% |
| 5TH YR | 62.8% | 53.3% | 19.9% | 11.4% |
| 6TH YR | 66.2% | 45.5% | 15.7% | 10.5% |
| 7TH YR | 68.5% | 49.8% | 13.4% | 9.6% |
| 8TH YR | 57.4% | 49.7% | 12.6% | 9.2% |
| 9TH YR | 40.9% | 49.8% | 12.2% | 10.0% |
| 10TH YR | 32.9% | 58.4% | 18.5% | 9.1% |
| 11TH YR | 39.8% | 57.8% | | |
| 12TH YR | 30.9% | | | |

Comments: DoD expects AMRAAM unit cost to fall to 39% of the initial production unit cost in two years. A reduction of this magnitude has still not been achieved on either the Sparrow or Phoenix and took until the third year for HARM. DoD also projects that AMRAAM unit cost will fall to about 9% percent of the original cost by the seventh year, which is not projected for any of these comparable missile programs.

ACTUAL AND ESTIMATED UNIT COSTS OF AIR-TO-AIR MISSILES
(Millions of FY84 Dollars)

| FISCAL YEAR | | PHOENIX | SPARROW (AF+N) | HARM (AF+N) | AMRAAM (AF+N) |
|---|---|---|---|---|---|
| FY80 | | 2.001 | 0.365 | | |
| FY81 | | 2.258 | 0.249 | 1.687 | |
| FY82 | | 2.251 | 0.249 | 0.963 | |
| FY83 | | 2.354 | 0.186 | 0.604 | |
| FY84 | | 1.256 | 0.194 | 0.597 | |
| FY85 | | 1.326 | 0.166 | 0.336 | |
| FY86 | ACTUALS | 1.370 | 0.182 | 0.265 | |
| FY87 | ESTIMATES | 1.149 | 0.181 | 0.226 | 2.552 |
| FY88 | | 0.819 | 0.182 | 0.212 | 0.999 |
| FY89 | | 0.658 | 0.213 | 0.206 | 0.497 |
| FY90 | | 0.796 | 0.211 | 0.313 | 0.303 |
| FY91 | | 0.619 | | | 0.290 |
| FY92 | | 0.604 | | | 0.267 |
| FY93 | | 0.594 | | | 0.244 |
| FY94 | | 0.587 | | | 0.235 |
| FY95 | | 0.581 | | | 0.255 |
| FY96 | | 0.577 | | | 0.232 |
| FY97 | | 0.540 | | | |
| FY98 | | 0.549 | | | |

Sources: Dec 84 SAR for all systems except AMRAAM, which combines Navy's Dec 84 SAR with AF Sep 85 SAR.

INPUTS

| | |
|---|---|
| LEARNING CURVE % (S) = | 81.40% |
| B = ln S/ln 2 = | -0.2969 |
| INITIAL CUM. AVG. UNIT COST = | 2.441 |

| YEAR | MISSILE QTY | CUMULATIVE AF & N MISSILE QTY | LEARNING CURVE FACTOR W/ BASE 1ST UNIT | LEARNING CURVE FACTOR W/ BASE 260TH UNIT | EXPECTED CUM. AVG. UNIT COST (FY84 $) | AIR FORCE MISSILE QTY | IMPLIED TOTAL COST (FY84 $) |
|---|---|---|---|---|---|---|---|
| FY84 | - | | | | | | |
| FY85 | - | | | | | | |
| FY86 | - | | | | | | |
| FY87 | 260 | 260 | 0.191865 | 1.000000 | 2.441 | 260 | 634.7 |
| FY88 | 1,183 | 1,443 | 0.115350 | 0.601201 | 1.468 | 1,093 | 1604.0 |
| FY89 | 2,500 | 3,943 | 0.085586 | 0.446072 | 1.089 | 3,043 | 3313.4 |
| FY90 | 3,648 | 7,591 | 0.070460 | 0.367237 | 0.896 | 5,643 | 5058.5 |
| FY91 | 3,000 | 10,591 | 0.063826 | 0.332662 | 0.812 | 7,443 | 6043.9 |
| FY92 | 3,000 | 13,591 | 0.059271 | 0.308919 | 0.754 | 9,243 | 6969.9 |
| FY93 | 3,000 | 16,591 | 0.055863 | 0.291157 | 0.711 | 11,043 | 7848.4 |
| FY94 | 3,000 | 19,591 | 0.053173 | 0.277137 | 0.676 | 12,843 | 8688.2 |
| FY95 | 2,264 | 21,855 | 0.051474 | 0.268284 | 0.655 | 14,643 | 9589.4 |
| FY96 | 2,480 | 24,335 | 0.049858 | 0.259857 | 0.634 | 17,123 | 10861.3 |
| TOTAL | 24,335 | | | | | | |

INPUTS

| | |
|---|---|
| LEARNING CURVE % (S) = | 81.40% |
| B = ln S/ln 2 = | -0.2969 |
| INITIAL CUM. AVG. UNIT COST = | 1.169 |

| YEAR | MISSILE QTY | CUMULATIVE AF & N MISSILE QTY | LEARNING CURVE FACTOR W/ BASE 1ST UNIT | LEARNING CURVE FACTOR W/ BASE 260TH UNIT | EXPECTED CUM. AVG. UNIT COST (FY84 $) | AIR FORCE MISSILE QTY | IMPLIED TOTAL COST (FY84 $) |
|---|---|---|---|---|---|---|---|
| FY84 | - | | | | | | |
| FY85 | - | | | | | | |
| FY86 | - | | | | | | |
| FY87 | 260 | 260 | 0.191865 | 1.000000 | 1.169 | 260 | 303.8 |
| FY88 | 1,183 | 1,443 | 0.115350 | 0.601201 | 0.703 | 1,093 | 767.9 |
| FY89 | 2,500 | 3,943 | 0.085586 | 0.446072 | 0.521 | 3,043 | 1586.3 |
| FY90 | 3,648 | 7,591 | 0.070460 | 0.367237 | 0.429 | 5,643 | 2421.8 |
| FY91 | 3,000 | 10,591 | 0.063826 | 0.332662 | 0.389 | 7,443 | 2893.6 |
| FY92 | 3,000 | 13,591 | 0.059271 | 0.308919 | 0.361 | 9,243 | 3336.9 |
| FY93 | 3,000 | 16,591 | 0.055863 | 0.291157 | 0.340 | 11,043 | 3757.5 |
| FY94 | 3,000 | 19,591 | 0.053173 | 0.277137 | 0.324 | 12,843 | 4159.5 |
| FY95 | 2,264 | 21,855 | 0.051474 | 0.268284 | 0.314 | 14,643 | 4591.0 |
| FY96 | 2,480 | 24,335 | 0.049858 | 0.259857 | 0.304 | 17,123 | 5200.0 |

B-221734 February 18, 1986

The Honorable Les Aspin
Chairman, Committee on
Armed Services
House of Representatives

Dear Mr. Chairman:

This briefing report is in response to your December 1985 request for an interim report on the development status of the Advanced Medium Range Air-to-Air Missile (AMRAAM), particularly as it relates to the certification requirements contained in the Defense Authorization Act, 1986. As you know, the act requires the Secretary of Defense to certify by March 1, 1986, that (1) the AMRAAM design is complete, (2) system performance has not been degraded from the original development specification, (3) the maximum practical number of cost reduction design changes have been incorporated into the flight test program and qualified before production, (4) a fixed price contract not to exceed $556,580,480 has been entered into for research, development, test, and evaluation, (5) total production cost, for a minimum 17,000 missiles, will not exceed $5.2 billion in fiscal year 1984 dollars, and (6) the missiles procured will perform in accordance with the development specification. If certification is not made, the act states that the AMRAAM program shall be terminated.

To determine the overall program status, we met with and obtained data from Air Force officials in Washington, D.C., and the AMRAAM Joint System Project Office (JSPO) at Eglin Air Force Base, Florida. We also visited and obtained data from the AMRAAM development contractor--Hughes Aircraft Company at Canoga Park, California, and Tucson, Arizona and the second source contractor--Raytheon Company at Bedford, Massachusetts. We conducted our work from November 1985 through January 1986.

As agreed with your office, we did not request official agency comments on this report. However, the views of Air Force, JSPO, and contractor officials were obtained and incorporated where appropriate.

A summary of our observations on the status of each certification requirement follows.

## DESIGN COMPLETION

The AMRAAM program manager and Air Force officials state that AMRAAM's design is essentially complete based on the Critical Design Review held between November 1984 and February 1985. A number of design modifications have occurred since that review. Hughes' officials state the design is complete, but acknowledge that design modifications will be made as the AMRAAM program proceeds through the test and evaluation phase. Additional design changes are planned to reduce AMRAAM production costs.

## PERFORMANCE DEGRADATION

The early flight test missiles have had a number of deviations from the contract specifications which, if not corrected, could impair missile performance. JSPO and Air Force officials state that these deviations are temporary and/or minor and acceptable.

## COST REDUCTION CHANGES

Most AMRAAM design changes to reduce production costs are scheduled to be incorporated in production lots #3 and #4 in 1989 and 1990, respectively. JSPO states that significant cost reduction design changes will be flight tested over the next several years.

FULL SCALE DEVELOPMENT CEILING OF $556.6 MILLION

Prior to November 1985, recorded obligations under the Hughes fixed-price contract for AMRAAM full-scale development totaled approximately $556.8 million. However, when the Defense Authorization Act, 1986, was passed in November 1985, it placed a $556,580,480 ceiling on the development cost. Subsequently, JSPO negotiated contract changes to reduce recorded obligations below the ceiling. The AMRAAM Program Manager believes the ceiling may restrain AMRAAM development.

PRODUCTION CEILING OF $5.2 BILLION

Estimated production cost of $5.2 billion, in fiscal year 1984 dollars, for 17,000 missiles for the Air Force over the next 10 years is based on a number of assumptions which cumulatively reduce confidence in the estimate.

MISSILE PERFORMANCE

Assessment of the missile's performance is limited at this time because few missiles have been produced and launch tested. As of January 1986, approximately 20 full scale development missiles had been delivered to various test facilities. About half of these have been returned to Hughes because of some malfunction. Four test missiles have been air launched.

The JSPO stated that all four of these tests were successful. A fifth air launch test on January 29, 1986 was aborted when the missile failed to launch. Current plans show that many additional launch tests are to be made by 1988. By then, these tests may have determined the ability of the missile to perform in accordance with the development specifications.

These issues are discussed in more detail in the enclosed appendixes.

As agreed with your staff, we plan no further distribution of this report until one day after its issue date. At that time, we will send copies to the Senate Committee on Armed Services, the Secretary of Defense, and to other interested parties.

Sincerely yours,

Bill W. Thurman

for Frank C. Conahan
Director

## OBSERVATIONS ON THE STATUS OF AMRAAM

## CERTIFICATION ISSUES

### BACKGROUND

The Advanced Medium Range Air-to-Air Missile (AMRAAM) is being developed jointly by the Air Force and Navy to meet their air-to-air missile requirements for the 1985-2005 time frame. The missile is to be compatible with the services' latest fighter aircraft. As a follow-on to the Sparrow medium-range air-to-air missile, AMRAAM is intended to improve interceptor combat effectiveness.

AMRAAM is to operate both within and beyond visual range. Performance features that are to provide improvement include higher speed, greater range, increased maneuverability, all aspect look-down shoot-down capability, better resistance to electronic countermeasures and an active terminal seeker. The active seeker and a track-while-scan radar aboard an aircraft provide the capability to simultaneously track multiple targets, launch multiple missiles and leave. The missile is also intended to be more reliable and maintainable.

The AMRAAM development program includes the missile, launchers, aircraft interfaces, support equipment and aircraft modifications for AMRAAM testing. Modifications to operational aircraft and eject launchers are to be developed and procured by the appropriate aircraft program offices. These offices will also procure the launchers.

The program is in full-scale development under a contract with Hughes Aircraft Company. Raytheon Company is being qualified as a follow-on second source producer for future competition.

JSPO procurement cost estimates have risen from about $10.4 billion in then year dollars for 24,335 missiles in November 1982, about $428,000 per missile, to $11.7 billion in December 1984, about $479,000 per missile. An Independent Cost Analysis made in December 1984 for the Air Force's 17,123 missiles projected a then year cost of about $490,000 per missile.

In fiscal year 1985 the Secretary of Defense expressed concern over the program's progress and escalating costs and ordered a complete review of the program to determine if and how program costs could be controlled. This review resulted in the program being restructured to stretch the missile's full scale development phase from 54 to 79 months and delay deployment from 1986 to 1989. To reduce program costs, a number of design and other changes were identified that could reduce manufacturing and production costs by an estimated $1.7 billion for the combined Air Force and Navy buy. This reduced JSPO's estimate for 24,335 missiles to $10.6 billion in then year dollars or $435,000 per missile. This latter estimate correlates to the $5.2 billion, in 1984 dollars, stated in the Defense Authorization Act, 1986 for 17,123 Air Force missiles. Included in the reduced estimate is an additional $330 million, in then year dollars, to make the cost reduction changes.

This report addresses the AMRAAM's status as it relates to each of the certification requirements contained in the Defense Authorization Act, 1986. It does not address the need for

AMRAAM, its performance requirements, effectiveness, or affordability.

DESIGN COMPLETION

The AMRAAM Program Manager and Air Force officials stated that the AMRAAM design is complete for purposes of meeting performance requirements, even though many live launch tests have not been made. Their views are based on the degree of design documentation, the degree to which the design exists in hardware, and the completion of the Critical Design Review. The Review, which was performed from November 1984 to February 1985, was made to determine, among other things, if the detail design satisfies the performance and engineering requirements. Contractor follow-on actions to satisfy outstanding Review issues took place during the remainder of 1985.

According to an Air Force official, the missile's basic design will not change unless the threat changes. The official did say, however, that there will be design modifications to reduce costs, but these changes will not affect performance. The official also stated that some minor redesigning may result from AMRAAM testing and production.

Hughes, the development contractor, stated that the design is complete. Raytheon, the second source contractor, believes the design is essentially complete. They acknowledge that as part of the full scale development phase, there will be design modifications resulting from development tests and evaluations and from manufacturing considerations.

DOD Directive 5000.3 states that development tests and evaluations are made to assist the engineering design and development process and to verify attainment of technical performance specifications. Operational tests and evaluations are conducted by the systems' users to determine, among other things, if modifications are needed.

As of January 1, 1986, Hughes had built and delivered for testing 20 of a planned 122 developmental missiles required under the full-scale development contract. These missiles are being used in a variety of scheduled tests. Four have been air launched and three of these were fired at targets. JSPO considers these test firings successful. A fifth test firing was aborted on January 29, 1986 when the missile did not launch. The cause of the malfunction is unknown at this time. Appendix II shows a listing of missiles produced and their test purposes.

Remaining design issues

As of January 1986, certain items have not been completed nor were they scheduled to be by this time. These include software tapes, which program and direct the missile based on given tactical situations, and proposed modifications to certain components to reduce costs. We also observed some difficulties in manufacturing the initial development missiles.

Software tapes

Four of five software tapes have been designed and three have been integrated into the initial missiles. The full capabilities of the AMRAAM cannot be tested until all of the tapes are designed and integrated. Missile capabilities provided by the addition of the second tape include a data link from the aircraft to the missile, look-down shoot-down features, software for fuzing, built-in-test information and high-pulse-repetition frequencies, to obtain more and better

target information. Tape three adds features such as multiple target tracking, initial electronic counter counter-measures and solutions to some targeting problems. The fourth and fifth tapes with more sophisticated electronic counter counter-measures are scheduled to be integrated in July 1986 and the spring of 1987. JSPO states that with the successful integration of the fourth tape, the AMRAAM will meet all its performance requirements.

Guidance components

Following the Critical Design Review and several air launch tests, the Seeker Servo unit, which drives the missile's antenna, was modified in the earlier built missiles as well as in the current ones. Also, the Radar Frequency Processor's design was modified. JSPO stated that the need for these changes were identified prior to the Critical Design Review.

Cost reduction design changes

Hughes and Raytheon have submitted proposals to JSPO to modify certain missile components and subcomponents to make the missile less costly to produce. Negotiations are underway between the JSPO and the contractors on some of the proposals.

JSPO estimated that it will take two years to design and qualify the proposed cost reduction changes and about another year will be required to fabricate and integrate the changes into the manufacturing process.

Manufacturing difficulties

At the Hughes facilities, we found that certain guidance system components were presenting manufacturing difficulties. For example, there have been difficulties in manufacturing the Receiver/Range Correlator. Hughes has retained the Correlator and the Electronic Unit's Input/Output section at its research and development facility at Canoga Park, California, while other guidance and control components have been transferred to the production plant in Tucson, Arizona, for assembly or manufacture. Hughes officials commented that these complex units were retained because of limitations in the learning rate, manufacturing capacity and workload at the Tucson plant.

PERFORMANCE DEGRADATION

Although the missile components and subcomponents have been designed to meet certain contract specifications, a number of deviations in the test missiles were found. These deviations, if not fixed, could impair missile performance. Both JSPO and the contractor consider these deviations temporary and/or minor and acceptable. The number of deviations has diminished as additional work and testing has progressed.

The deviations involved the radar, launch time, guard antenna, and the physical environment. They include:

--A problem with the radar receiver protection device. This problem, if not corrected, would adversely affect the missiles' acquisition range. (The JSPO Program Manager said design solutions have been undertaken and the modifications will be flight tested in November 1986).

--Increase in launch sequence time, which would increase the time between firings up to half second. (The Program Manager stated an engineering change is planned to relax the requirement.)

--Guard antenna capability does not meet its specifications at extreme bore sight angles. (According to the contractor, this would not reduce electronic counter counter-measures' capability. The Program Manager stated that proposed design modifications will be flight tested in 1987).

--Temperature specification extremes have not been met. (JSPO will consider possible modifications or reducing the requirement.)

## COST REDUCTION CHANGES

JSPO states that 10 missiles from production lot #1 will be used to incorporate and test cost reduction design changes over the next several years. Most of these changes will be incorporated into production lots #3 and #4 scheduled for 1989 and 1990 respectively.

Recently, the first increment of the contractors' cost reduction proposals were evaluated and selections were made by JSPO. The Air Force and the Department of Defense are now reviewing these with initial contract award planned in March 1986.

## FULL-SCALE DEVELOPMENT CEILING OF $556.6 MILLION

Before the November 8, 1985, enactment of the Defense Authorization Act, 1986, JSPO's recordable obligations with the development contractor exceeded the act's $556.6 million ceiling by about $200,000. In December 1985, JSPO awarded a contract modification which deleted certain requirements and resulted in a downward adjustment of these obligations to comply with the March 1, 1986, certification ceiling.

The original full scale development contract was a fixed-price incentive fee contract negotiated in December 1981. The contract ceiling of $556.6 million was reached by May 31, 1985. Appendix III shows the cumulative obligations at May 31, 1985, the contract modifications made through December 1985, and the reasons for these changes.

The AMRAAM Program Manager informed us that obligations above the ceiling are needed to minimize risk. JSPO had planned to open a third test site for AMRAAM at Eglin Air Force Base and procure a third captive flight test vehicle in the latest configuration. He said these actions would also necessitate support from Hughes in order to take advantage of near-term developments. He believes that, if additional contractor funding is not authorized, flexibility in testing would be inhibited, but he emphasized such authorization is not needed for missile design purposes.

AMRAAM's total estimated development cost to the Government, as outlined in the August 1985 Office of the Secretary of Defense Program Review, was $1.35 billion. Additionally, Hughes Aircraft Company anticipates that it will absorb $255 million toward developing the AMRAAM, making the total estimated development cost $1.6 billion.

## PRODUCTION CEILING OF $5.2 BILLION

The Air Force's estimated production cost of $5.2 billion in fiscal year 1984 dollars for 17,123 missiles is based on a number of assumptions. The accuracy of these assumptions is essential to the $5.2 billion estimate. Historically, similar assumptions, for other major acquisitions, have changed over

time. The potential for such changes reduces confidence in the estimate being achieved. Raytheon estimated the cost for these missiles to be somewhat less than the Air Force's production estimate. JSPO stated the $5.2 billion estimate is conservative.

Some of the assumptions include:

--Joint service funding will approximate $1 billion annually, in then year dollars, over a 9 year period beginning in fiscal year 1988.

--The Navy will buy 7,212 missiles beginning in fiscal year 1989, for a total production of 24,335 missiles.

--A full production rate of 3,000 missiles annually will be maintained for 7 years beginning in fiscal year 1990. (Recent Sparrow procurement history shows that annual and total planned purchases often vary from actual purchases. However, the estimate does not include the potential for foreign military sales which could increase total production and reduce unit cost.)

--Most cost reduction design modification will be fully developed and integrated into production lots #3 and #4 in fiscal year 1989 and 1990, respectively.

--The combined Air Force/Navy buy will have design and other changes that will save $1.7 billion in then-year dollars. About $1.2 billion in savings would be applicable to the Air Force procurement. (An Air Force official stated that this is a conservative estimate and represents only 75 percent of the anticipated savings.)

--No model or major design changes will be made to the missile over the next 10 years. (The Department of Defense has already endorsed future producibility and performance improvements that emphasize technology for an advanced seeker and an advanced processor.)

--Large savings will result from competition at both the prime and subcontractor levels, beginning with production lot #3. (JSPO currently plans to purchase lots #1 and #2, totaling over 1,000 missiles noncompetitively. This low rate production is based upon an allocation to the two contractors. The two lots represent 4.5 percent of the total production quantity and 17.9 percent of the estimated total production cost, which includes nonrecurring expenses. Also, a number of major and critical subcontractor items are now being bought noncompetitively.)

--Unit production costs will drop from about $3.1 million per missile in 1987, which includes nonrecurring start-up costs, to about $360,000 per missile, in then year dollars, in 1990. (This is based on funding, production quantity, production rate, and many other assumptions.)

MISSILE PERFORMANCE

To validate missile performance, numerous tests such as captive carry, software and hardware integration, reliability, environmental, electromagnetic and live air launched flights are underway. During the full-scale development phase, 122 test missiles are to be built and delivered by Hughes. Some of the types of tests are shown in Appendix II.

DOD officials state that 20, out of the contracted 122 missiles, have been produced and delivered to field test facilities such as the Pacific Missile Test Center, Point Mugu, California; Holloman Air Force Base, New Mexico; Raytheon Company's Bedford, Massachusetts, plant; and General Dynamics' Fort Worth, Texas, plant. About half of these missiles were returned to Hughes to correct some malfunction. Hughes analyzed the problems and modified or replaced the components or subcomponents as needed. In some cases it was found that the missile test equipment had difficulties and had to be modified. Appendix IV describes some of the significant malfunctions and the actions taken.

AMRAAM's performance specification requires a high kill probability under a variety of combat, weather, and electronic counter-measure conditions. This combat performance value--the probability of kill--differs from physical performance measurements such as weight or speed, in that it is determined analytically. The probability of kill performance criterion is determined from a series of factors that must be considered together. Examples of these are prelaunch reliability, in-flight reliability, guidance accuracy, fuze accuracy and warhead destruction capability. To attain a high confidence that these factors will achieve the desired probability of kill levels, a large number of environmental tests, ground simulations, captive flights and flight tests must be made against various types of targets.

Such a volume and variety of testing is not scheduled to be completed by March 1, 1986, to provide sufficient assurance of meeting the desired performance criteria. This is not unusual for this phase of a program. The current plan shows that by 1988, 90 flights will have been completed using four types of aircraft as part of the Development Test and Evaluations and the Initial Operating Test and Evaluations. By then, these tests may have determined the ability of the missile to achieve its required kill capability.



MISSILES PRODUCED BY HUGHES AIRCRAFT COMPANY

FOR FULL SCALE DEVELOPMENT TEST PURPOSES

AS OF DECEMBER 31, 1985

| No. of Missiles | Test Program | Purpose |
|---|---|---|
| 4 | Test, Analyze and Fix | Reliability and environmental testing |
| 2 | AMRAAM Captive Equipment | Software and aircraft integration |
| 1 | Software Integration | Software development |
| 2 | Government Simulation Hardware | Performance simulation |
| 1 | Proof of Design | Engineering design checks |

| | | |
|---|---|---|
| 2 | Integration Test | Aircraft integration |
| 4 | AMRAAM Air Vehicles-Instrumented | Launch flights |
| 1 | Separation/Control Vehicle | Separation and missile performance |
| 1 | HERO/Have Note | Electromagnetic environmental tests |
| 1 | Environmental Test Vehicle | Qualification test |
| 1 | Follower Missile | Follow-on contractor training |
| 20 | | |

APPENDIX III

APPENDIX III

MODIFICATIONS TO THE AMRAAM FULL SCALE DEVELOPMENT CONTRACT

FROM MAY 31, 1985 THROUGH DECEMBER 31, 1985

| Date/and modification number | Purpose of modification | Recordable obligation amount | Total |
|---|---|---|---|
| 5/31/85 | - | - | $556,580,480 |
| 7/31/85 (P00071) | Preliminary design study of the metal composite for AMRAAM launchers to determine weight savings and production cost impact | $125,859 | 556,706,339 |
| 7/19/85 (P00072) | Additional qualification test on the Safe-Arm Firing Device | 81,000 | 556,787,339 |
| 11/08/85 (P00073) | Adjustment to prior recordable obligation (P00072) | -8,370 | 556,778,969 |
| 12/20/85 (P00076) | Deletion of contractor inspection and repair as necessary of three reliability test vehicles to comply with authorizing legislation. | -411,612 | 556,367,357 |

DESCRIPTION OF MISSILE TEST ANOMALIES AND ACTIONS TAKEN

At the Pacific Missile Test Center at Point Mugu, California, three Test Analyze and Fix missiles were tested for reliability and environmental effects. The power up sequence for one missile was incorrect resulting in failures of its electronic units' board and harness. The sequence error was caused by test set equipment problems and not with the missile itself. A second missile experienced a telemetry system failure. A third missile had a control section failure, caused by the accidental opening of the test chamber, which resulted in condensation damage to some of the missile's subcomponents. The three missiles were returned to Hughes for repair.

An Integration Test missile was sent to McDonnell Douglas and another to General Dynamics for aircraft integration tests. Both missiles experienced built-in test equipment failures. One had a telemetry unit failure and the other had a filter rectifier problem. These missiles were returned to the contractor for analyses and rework.

One missile was sent to Raytheon Company for training purposes. That missile would not power up. It was returned to Hughes for analysis. An electronic conversion unit in that missile was replaced.

The four air launched tests were considered successful by JSPO. In the first air launch, the missile had some instability in its flight. This was corrected by modifying the tape 2 autopilot software, which activates the control section before the missile leaves the aircraft. The second launch flight revealed sudden changes in terminal steering. A third showed a few terminal problems. The fourth revealed no anomalies; it knocked down the target drone.

A fifth air launch test scheduled for December 1985 was postponed until mid January 1986, because ground tests revealed a power problem with the transmitting tube's coil. The missile was returned to Hughes for further testing, evaluation, and component replacement.

The mid January test was further delayed when a replacement missile was found to have a hardware problem. This missile was returned to Hughes' Canoga Park facility for repair.

At the end of January another flight test was attempted. The missile self aborted because of internal power problems. This missile was also returned to the contractor for further analyses.

(392181)

Mr. STRATTON. Thank you, General. In view of the arguments that have been made as to whether the AMRAAM has, in fact, been certified, we have asked Mr. James Hinchman, deputy general counsel of the GAO, to give us his analysis as to whether this is an adequate certification.

## STATEMENT OF JAMES F. HINCHMAN, ACCOMPANIED BY JAMES WIGGINS, GROUP DIRECTOR, NATIONAL SECURITY AND NATIONAL AFFAIRS DIVISION, GENERAL ACCOUNTING OFFICE

Mr. HINCHMAN. Good morning, Mr. Chairman.

I am James Hinchman, deputy general counsel of the GAO. With me is James Wiggins, who is the Group Director in our National Security and National Affairs Division at GAO.

I want, first of all, to say we have no movies. And after that impressive film, my remarks may seem somehow less dramatic.

As this committee knows, the 1986 authorization act provides that $54.4 million of the funds appropriated to the Air Force for research, development, test, and evaluation of the AMRAAM Program are not available for obligation or expenditure until the Secretary of Defense gives the Committees on Armed Services of both Houses of Congress certification concerning the current status and future cost of the program.

On February 28, the Secretary of Defense gave his certification to the committees. In it, the Secretary certifies to precisely those things to which section 210 requires him to certify. Indeed, the certification repeats word for word the language of the statute. Attached to the certification is a statement of additional information that gives some explanation of the basis for which the certification was made. Chairman Aspin has asked us to review that certification and consider whether it fulfills the requirements of section 210.

Mr. Chairman, we have a fairly lengthy statement on that subject which we would, with your permission, like to incorporate in the record. If you don't mind, I will just summarize it briefly now. Would you prefer I do it all, sir?

Mr. STRATTON. Just so that you don't cover up anything that we need to determine an answer to this. If it is a complicated statement, we still have to listen to it.

Mr. HINCHMAN. Perhaps it would be best then if I did the entire statement, sir.

Section 210 describes in detail what must be certified: That design of the AMRAAM system is complete; that system performance has not been degraded from the original development specification, as amended; that the flight test program has been revised to incorporate the maximum practicable number of design changes that reduce costs and are qualified and flight tested before production; that there is a fixed-price type contract for not more than approximately $556.6 million for research, development, test, and evaluation of the program; that the total production cost for the program, for a minimum of 17,000 missiles, will not exceed $5.2 billion in fiscal year 1984 dollars, and that the missile will perform in accordance with the development specification.

At the outset, it is important to recognize, we think, that this certification required of the Secretary is not a ministerial act. Some elements of the section are open to varying interpretations. In particular, there are questions of what is meant by "design completion" and the cost for "a minimum of 17,000 missiles" when current planning and cost projections are based on the procurement of 24,000 missiles.

Some of the matters to which the Secretary must certify call for the exercise of judgment.

Mr. STRATTON. Where are you reading?

Mr. HINCHMAN. I am at the top of page 3, sir.

Mr. STRATTON. Thanks.

Mr. HINCHMAN. As I just said, some of the matters to which the Secretary must certify call for the exercise of judgment. For example, it is a matter of judgment whether the maximum practicable number of cost reducing changes have been incorporated in the design of the system. Some judgment is also involved in deciding whether system performance has been degraded. As noted below, several system engineering changes are being considered which may degrade system performance.

Some matters to which the Secretary must certify, for example, the production cost of 17,000 missiles, require forecasting the future.

These questions of interpretation, judgment, forecasting, and the underlying factual situation out of which they arise, are all matters on which views can differ. The statement that accompanies the Secretary's certification, as well as our review of the certification process, give us some information regarding his views. Those views are not universally shared. But it is the Secretary who is charged by section 210 with making the certification on which the continuation of the AMRAAM program and the availability of some $54.4 million for it are dependent.

He is, therefore, necessarily the one who has the responsibility for reaching the conclusions and judgments required to determine if the certification can be given. The Secretary has concluded he can provide the certification required by section 210 and has done so. We do not believe there is any legal basis for objecting to the release of the $54.4 million held in reserve pending the Secretary's certification solely because of disagreement with conclusions or judgments that he reached in executing it. However, I think it is important to be clear that is a lawyer's conclusion.

This does not mean that there are no longer any grounds for the concerns which lead to the enactment in section 210. Uncertainties as to cost, scheduling, and performance remain. With this in mind, Mr. Chairman, I would now like to summarize the results of our review of the AMRAAM certification process. We have previously provided Chairman Aspin with a briefing report on some of these matters.

First consider the question of design completion. The Secretary's certification is based on, one, the completion of activities associated with the critical design review [CDR]—an analysis of the AMRAAM basic design—and, two, congressional recognition that design refinements, including those intended to reduce cost, are normal during the development stage of a missile.

However, at the time of the certification, contractor action had not been completed on 10 percent of the changes required as a result of the CDR, and the design and integration of software tapes—which are necessary for the full testing of AMRAAM capabilities—had not been finished. Design refinements will continue to occur during testing, evaluation, and production to enhance reliability and producibility.

We have also looked at the question of performance specification degradation. Flight testing, laboratory environmental qualification testing, simulation, and basic design information were among the data reviewed before the Secretary certified that system performance had not been degraded from the development specifications as amended. However, the early flight test missiles had a number of deviations from contract specifications, which, if not corrected, could impair missile performance. DOD officials believe that these deviations are temporary and/or minor or acceptable. In our opinion, pending engineering change proposals could also reduce performance.

Third, we have looked at the flight test program revisions for cost reduction. The program plan for design changes resulting from cost reductions, producibility enhancement plan, calls for the appropriate testing of design changes before they are incorporated into missile production. However, few, if any, changes will be qualified, flight tested, and integrated into production lots 1 and 2, which total about 1,000 missiles. Critical cost reduction changes are scheduled to be flight tested before production of lots 3 and 4, which total about 5,000 missiles. However, any slippages in the production of lot 1 could delay the flight testing of cost reduction changes even further.

Next we consider the question of full-scale development ceiling of $556.6 million. The Air Force entered into a fixed-price type contract with Hughes Aircraft in December, 1981 for the research, development, test, and evaluation of the AMRAAM program. Before the enactment of the DOD Authorization Act, 1986—November 8, 1985—recordable obligations with the development contractor—Hughes Aircraft—exceeded the act's ceiling by about $200,000. The obligations were adjusted downward through a contract modification to comply with the certification ceiling.

Nevertheless, the AMRAAM program manager has indicated that Government costs above the ceiling are needed to permit flexibility in missile testing. As we understand it, this flexibility would permit an additional test site at Eglin Air Force Base.

We next looked at the production cap of $5.2 billion for a minimum of 17,000 missiles. The Secretary's certification of $5.2 billion 1984 fiscal year dollars for a minimum of 17,000 missiles is based on a combined Air Force-Navy program of approximately 24,000 missiles.

Even assuming a program of 24,000 missiles, if only 17,000 Air Force and Navy missiles are produced, the cost in 1984 fiscal year dollars would be in excess of the $5.2 billion ceiling by about $500 million.

Further, the Secretary's certification reflects a number of assumptions which may cumulatively reduce confidence in achieving the cost estimate. Some principal assumptions are that, first, joint

service funding will approach about $1 billion annually for the 9-year period beginning with fiscal year 1988; second, no model or major design changes will be made over the next 10 years; and, third, no significant schedule slippages will occur.

Finally, we have considered the question of missile performance. Several flight tests have so far been conducted to determine whether the missile will perform in accordance with the development specification. These include three guided live firings and two separation/control flights, all of which were considered successful by the program office. However, the last four launch attempts have been aborted.

To attain a high degree of confidence that the missile will achieve its performance specification, a large number and variety of tests remain to be conducted. These tests were not scheduled for completion by March 1, 1986. The current plan calls for 90 scheduled flights in four kinds of aircraft by 1988.

That concludes my summary of our review of the certification process, and Mr. Wiggins and I are ready to answer any questions you have.

### Prepared Statement of James F. Hinchman

Mr. Chairman and members of the committee, I am pleased to appear before the Subcommittee today to discuss the views of the General Accounting Office on the certification which the Secretary of Defense has provided Congress under section 210 of the 1986 Defense Authorization Act concerning the advanced medium range air-to-air missile (AMRAAM) program.

As this Subcommittee knows, the 1986 Act authorized approximately $101.4 million in Air Force research, development, test, and evaluation funds for the AMRAAM program. Section 210 provides that approximately $54.4 million of the amount appropriated under the authorization may not be obligated or expended until the Secretary of Defense gives the Committees on Armed Services of both Houses of Congress a certification concerning the current status and future cost of the program. The statute also provides that the AMRAAM program will be terminated if the Secretary of Defense does not make this certification. Section 210 describes in detail what must be certified:

That design of the AMRAAM system is complete.

That system performance has not been degraded from the original development specification, as amended.

That the flight test program has been revised to incorporate the maximum practicable number of design changes that reduce costs and are qualified and flight tested before production.

That there is a fixed-price type contract for not more than approximately $556.6 million for research, development, test, and evaluation of the program.

That the total production cost for the program, for a minimum of 17,000 missiles, will not exceed $5.2 billion in fiscal year 1984 dollars, and that the missile will perform in accordance with the development specification.

On February 28, the Secretary gave his certification to the two Committees. In it, the Secretary certifies to precisely those things to which section 210 requires him to certify. Indeed, the certification repeats, word for word, the language of the statute. Attached to the certification is a statement of additional information that gives some explanation of the basis on which the certification was made. Chairman Aspin has asked us to review the certification and consider whether it fulfills the requirements of section 210.

The certification which is required of the Secretary by section 210 is not a ministerial act. Some elements of the section are open to varying interpretations. In particular, there are the questions of what is meant by "design completion" and the cost for "a minimum of 17,000 missiles" when current planning and cost projections are based on the procurement of 24,000 missiles.

Some of the matters to which the Secretary must certify call for the exercise of judgment. For example, it is a matter of judgment whether the maximum practicable number of cost reducing changes have been incorporated in the design of the system. Some judgment is also involved in deciding whether system performance

has been degraded. As noted below, several system engineering changes are being considered which may degrade system performance.

Some matters to which the Secretary must certify, *e.g.*, the production cost of 17,000 missiles, require forecasting the future.

These questions of interpretation, judgment, forecasting, and the underlying factual situation out of which they arise, are all matters on which views can differ. The statement that accompanies the Secretary's certification, as well as our review of the certification process, give us some information regarding his views. Those views are not universally shared. But it is the Secretary who is charged with making the certification on which the continuation of the AMRAAM program and the availability of some $54.4 million for it are dependent. He is, therefore, necessarily the one who has the responsibility for reaching the conclusions and judgments required to determine if the certification can be given. The Secretary has concluded he can provide the certification required by section 210. We do not believe there is any legal basis for objection to the release of the $54.4 million held in reserve pending the Secretary's certification solely because of disagreement with conclusions or judgments that he reached in executing it.

This does not mean that there are no longer any grounds for the concerns which lead to the enactment of section 210. Uncertainties as to cost, scheduling, and performance remain. With this in mind, Mr. Chairman, I would now like to summarize the results of our review of the AMRAAM certification process. We have previously provided Chairman Aspin with a briefing report on some of these matters, "Missile Development—Status of Advance Medium Range Air-to-Air Missile (AMRAAM) Certification" (GAO/NSIAD 86-66BR, February 18, 1986). The material which follows is based on this briefing report and subsequent audit work on the AMRAAM certification process.

## DESIGN COMPLETION

The Secretary's certification is based on (1) the completion of activities associated with the Critical Design Review (CDR)—an analysis of the AMRAAM basic design—and (2) congressional recognition that design refinements, including those intended to reduce cost, are normal during the development stage of a missile. However, at the time of the certification, contractor action has not been completed on 10 percent of the changes required as a result of the CDR; and the design and integration of software tapes—which are necessary for the full testing of AMRAAM capabilities—had not been finished. Design refinements will continue to occur during testing, evaluation, and production to enhance reliability and producibility.

## PERFORMANCE SPECIFICATION DEGRADATION

Flight testing, laboratory environmental qualification testing, simulation, and basic design information were among the data reviewed before the Secretary certified that system performance had not been degraded from the development specifications as amended. However, the early flight test missiles had a number of deviations from contract specifications, which, if not corrected, could impair missile performance. DOD officials believe that these deviations are temporary and/or minor or acceptable. In our opinion, pending engineering change proposals could also reduce performance.

## FLIGHT TEST PROGRAM REVISIONS FOR COST REDUCTION DESIGN CHANGES

The program plan for design changes resulting from cost reductions (Producibility Enhancement Plan) calls for the appropriate testing of design changes before they are incorporated into missile production. However, few, if any, changes will be qualified, flight tested, and integrated into production lots 1 and 2, which total about 1,000 missiles. Critical cost reduction changes are scheduled to be flight tested before production of lots 3 and 4, which total about 5,000 missiles. Any slippages in the production of lot 1 could delay the flight testing of cost reduction changes even further.

## FULL-SCALE DEVELOPMENT CEILING OF $556.6 MILLION

The Air Force entered into a fixed-price type contract with Hughes Aircraft in December 1981 for the research, development, test, and evaluation of the AMRAAM program. Before the enactment of the DOD Authorization Act, 1986 (November 8, 1985), recordable obligations with the development contractor (Hughes Aircraft) exceeded the Act's ceiling by about $200,000. The obligations were adjusted downward through a contract modification to comply with the certification ceiling. Neverthe-

less, the AMRAAM program manager has indicated that government costs above the ceiling are needed to permit flexibility in missile testing. An additional AMRAAM test site at Eglin Air Force Base would be opened and a third captive flight test vehicle procured. The program manager stated that no additional government funding is, however, needed for missile design.

PRODUCTION COST—$5.2 BILLION CEILING FOR MINIMUM 17,000 MISSILES

The Secretary's certification of $5.2 billion 1984 fiscal year dollars for a minimum of 17,000 missiles is based on a combined Air Force/Navy program or approximately 24,000 missiles.

Even assuming a program of 24,000 missiles, if only 17,000 Air Force and Navy Missiles are produced, the cost in 1984 fiscal year dollars would be in excess of the $5.2 billion ceiling by about $500 million.

Also, the Secretary's certification reflects a number of assumptions which may cumulatively reduce confidence in achieving the cost estimate. Some principal assumptions are that (1) joint service funding will approach about $1 billion annually for the 9-year period beginning with fiscal year 1988; (2) no model or major design changes will be made over the next 10 years; and (3) no significant schedule slippages will occur.

MISSILE PERFORMANCE

Several flight tests have so far been conducted to determine whether the missile will perform in accordance with the development specification. These include three guided live firings and two separation/control flights, all of which were considered successful by the program office. However, the last four launch attempts have been aborted.

To attain a high degree of confidence that the missile will achieve its performance specification, a large number and variety of tests remain to be conducted. These tests were not scheduled for completion by March 1, 1986. The current plan calls for 90 scheduled flights in four kinds of aircraft by 1988.

Mr. Chairman, that concludes my testimony. I welcome any questions concerning the matters discussed.

Mr. STRATTON. Do you ever give anybody 100 percent?

Mr. HINCHMAN. No, sir.

Mr. STRATTON. I don't know how we ever got through the previous wars that we fought. We got the DIVAD that is no good, the Bradley is no good, the AMRAAM is no good. Do we have to have absolute perfection?

You pointed out at the beginning of your statement that there are a number of interpretations that might be made to some of these facts.

Mr. HINCHMAN. There is no question about that, sir.

Mr. STRATTON. It seems to me what we are doing is creating a class of individuals who are determined to destroy any of the weapons systems that we have by requiring they be absolutely perfect in every regard. We didn't do that in World War II. We haven't done it in other operations. I think for this to be helpful, we are going to have to have some more detail as to the differences between your views and the ones that the Secretary has produced, and that is going to delay things even further.

General, do you want to comment on these points that the GAO has made?

General FERGUSON. I appreciate that, sir. Let me say GAO has a difficult job. I think when they come into a program and try to understand it and although they have worked very diligently and hard at it, it is a complicated missile, and we have encouraged them to utilize knowledgeable people with technical backgrounds, and I think that we would agree their investigation has been hin-

dered by not having those kinds of engineers participate up to this point in time.

A few things about design completion. We said that the design process was complete, and indeed it is complete. Critical design review is a milestone where we note that. At this point, we are evaluating the design, and certainly we expect to find uncovered deficiencies, as we go through the evaluation, but I do believe the design of the missile we intend to put into production is essentially complete, and all we will do now are correct those deficiencies that we find in test and evaluation.

Performance specifications, certainly we have had some of these early flight missiles that have gone into flight test with some deviations. However, we have no hardware problems at the present time for which we do not have fixes and have identified missiles in the flight test program that will work in full compliance with the specifications. Likewise, where we anticipate the specifications will be changed, those changes are not in contradiction to the law, to the two specifications documents that were called out in the law.

We do not expect any changes we would make to specifications to be in conflict with the call out in the law. We are doing everything possible as far as producibility of the enhancement program is concerned to make this missile less costly to manufacture. We are doing that as rapidly as we can. We are utilizing the benefit of competition, our producibility program has been competed between the Raytheon and the Hughes Aircraft Co.

We are also expanding the number of vendors in the programs so that where we are currently relying on only one vendor for some critical components, we will now have more than one, and he will flight test as appropriate, or certainly go through a very disciplined qualification process, every change we intend to make before that change is approved into the production line.

The contract ceiling with Hughes Aircraft Co. is currently $200,000 less than is required by the law. As has been noted, we did go above that level in July of last year, but that was prior to the time the law was enacted. We did make an adjustment to the contract with Hughes Aircraft Co., and as I mentioned, we are now below that ceiling which is required by the law. It is true that I would like to have the flexibility to contract with Hughes Aircraft Co. for things that I feel are necessary and in the best interest of the program in order to complete it in a timely fashion. Of course, that is the reference to my desires.

I do not need to make those changes in order to successfully complete the program. However, I would like the flexibility to do that, and I believe if I had that flexibility, I could better manage the program to conclusion.

Dr. Cooper. Mr. Chairman, on that point, I am sorry to interrupt, but I think you need to make the point we are not asking for additional funds to do that. We are not asking to have our budget increased. What the program manager is asking is to have the flexibility within the funds he already has to do the things that are in the best interest of the program. We can't do that right now, and we won't do that right now because the law says we are capped.

But it seems to me to be somewhat foolish to go this far in a program if it is going to go forward with 95 percent of the R&D funds in hand and not give the program manager the flexibility to spend the money in the best way and in the best interest of the program.

Mr. STRATTON. Are you giving him the flexibility or are you not giving him the flexibility?

Dr. COOPER. I don't think I can give him the flexibility. The law says the amount of money we can provide to Hughes Aircraft on the fixed price is $556.7 million and not a penny more. I think the intent of Congress was to hold the contractor's feet to the fire and not let him out of the contract, and we fully intend to do that. He will build the content that that contract calls for with those dollars.

What General Ferguson is saying is as far as testing his missile is concerned, he needs to rearrange some monies within his account to go forward and complete his test. He is not asking for additional funds, he would like to use that contracting vehicle to do it. And the way the law is currently structured, in our opinion, we cannot do it. We have directed no additional funds will be placed on the contract. We would like to discuss that with you at some point. There are bigger issues than that one, but that is one of the constraints this certification puts on us.

Mr. SCRIVNER. Mr. Secretary, are you saying you would stay within the cap but rearrange funds? Is that what you are saying?

Dr. COOPER. No, what we say is within the R&D program that we show here, the numbers we are requesting within our budget—Mr. Scrivner, to point out $556.7 million is just one part of the R&D program. Those are the funds that go to Hughes Aircraft.

In addition to that, we have additional activities that we need to do in the Government's interest. It turns out in this particular case, the most convenient way to add a third test site and to add another captive test vehicle would be to add funding to the Hughes contract. That would be additional content, and we would pay an additional sum of money, but we would do that within the overall budget we are requesting. So it does not represent a cost increase in the program.

General FERGUSON. Two more comments, sir. With regard to the production cost, the $5.2 billion, of course, this program anticipates buying 24,000 missiles, 17,000 for the Air Force and the balance for the Navy. Our estimate has always anticipated that we would be buying those programs at a point in time when we would essentially have a cumulative benefit from both services procuring the missiles.

The $5.2 billion for 17,000 missiles always anticipated that we would be buying the additional 7,000 missiles for the U.S. Navy, and it was on that basis, of course, that our estimate was made to the Secretary last summer, and it was that basis upon which the information was provided to the various committee members at the time that the law was drafted.

I am firmly convinced that this program can be bought, that 24,000 missiles can be bought from Hughes and Raytheon for the $7 billion in fiscal year 1984 cost of dollar terms.

Finally, as far as missile performance is concerned, we have had four missile aborts, those missiles have aborted on the rail. The

missile is mechanized in such a way so that during that critical second or two, from the time the pilot hits the trigger to the time the missile goes off, the missile does a self-check. And, indeed, in this phase of the program, early in development, we have had four missile aborts on the rail.

I am not pleased with that. However, it is also, I think, very beneficial to us. We have brought those missiles home and have been able to identify what the problem is and have corrected it. If you will go back and research the AIM-7 Sparrow experience, I think you will find those missiles got off the rail and crashed onto the desert floor, and it took more time to go back through and investigate what went on. So we are not pleased that we have had those aborts. However, we are satisfied that the missile operated correctly under those conditions and self-aborted and we have been able to identify the problems.

That would conclude my comments, sir.

Mr. SPRATT. I think everybody on this subcommittee agrees with the objective of replacing the Sparrow with a lighter air-to-air intermediate range missile with launch and leave capability. I don't think there is any question about that. Since we have consensus on that, let me ask you if you would also agree we need to bring this replacement missile in at a cost below $500,000 per unit?

Dr. COOPER. We would like to bring it in lower than that if it were possible. What the Secretary has certified to is we can bring in 17,000 missiles at $5.2 billion or less in 1984 dollars.

Mr. SPRATT. I understand that is a section 210 requirement, I believe.

Dr. COOPER. Right.

Mr. SPRATT. What I am saying is you would agree this is a reasonable objective, buy enough so we can have a complement for each of our tactical aircraft?

Dr. COOPER. I certainly agree. We want to bring it in at that cost or lower, if possible.

Mr. SPRATT. Our concern is we are buying into the program at this point on rather phenomenal assurances of production efficiencies that will be achieved over the next several years. Wouldn't you agree that we are looking at a rather unprecedented learning curve based on unit costs to date if we are to achieve the average unit costs you are shooting at?

Dr. COOPER. I wouldn't say they are unprecedented. I would say they are aggressive learning curves. But we believe with the producibility program we now have underway, and I think the program is stronger for the producibility program we have put into effect and the vigorous competition that we have ongoing between Raytheon and Hughes, that we can bring it in at those costs.

I might mention, Mr. Spratt, if I could, just to amplify, this program, where it stands today, is in every respect stronger than the program we brought to you last year. And, as you recall, certification aside, we didn't take the certification lightly, but to me that is an issue that should be behind us. We are arguing technical details, whether we dot an "I" or cross a "T."

Mr. SPRATT. What GAO stated as certification is legally sufficient. The question now is not—the certification would have called for an immediate cessation of funding.

Dr. COOPER. Yes, sir. It is binary. We either certified or didn't certify.

Mr. SPRATT. The question now is, do we put money into procurement at this time or more money into tests and reduce the concurrence?

Dr. COOPER. We want to urge you to do that, but if I could, to give you my view of the certification, is that I think what the Congress asked, and we didn't object to that, was to get Secretary Weinberger's personal views on AMRAAM and whether or not he thought it was affordable. I think even more importantly, in his mind, whether or not he thought it would work. I can tell you that has been an arduous task for us over the last year, and he has not rubber-stamped every issue like that.

Mr. Chairman, you mentioned DIVAD as the case in point that was terminated under similar circumstances. And I would tell you very openly Mr. Weinberger, and I use the term "has wire-brushed the hell out of us for the last year to try to get a handle on these costs," and we told you that.

Mr. SPRATT. I have a wire brush here I would like to use before we get through. Let me give you one of the marvels of having a PC–18 in your office and see if these numbers will help us.

Now we may have our numbers right, we may have them wrong, I am asking for your assistance.

Mr. STRATTON. Do you want to talk into the microphone? Your back is to us, and we can't hear what you are saying.

Mr. SPRATT. As we understand the unit cost reductions that have been achieved historically in other air-to-air missile programs—we have lined up here the Phoenix, HARM, Sparrow, and AMRAAM—the Phoenix is driving toward a cost reduction of about 30.9 percent, in other words, the unit cost reduction in the 12th year would be 30.9 percent of the unit cost in the first year; Sparrow is about 57.8 percent, so the system that AMRAAM would replace is achieving somewhere around 50-percent unit cost reduction over the original unit cost in its early years of production. HARM is doing better than any of them. AMRAAM, on the other hand, seems to me to be unprecedented in what we are assuming for unit cost reduction.

Now, of course, the question here is, what is the base line? We have a high cumulative unit cost because we are combining everything spent to date in the units we have now.

Dr. COOPER. And the production rate as well. In the second year we are producing the same number of Sparrows as Phoenix as HARM as AMRAAM because when you look at a learning curve, what you talk about is every time you double the number of units you produce, you bring down the cost a certain percentage. It is hard for me to track this because I don't know what the production rates are on Phoenix, Sparrow, and HARM relative to what they are on AMRAAM.

Mr. SPRATT. There are lots of caveats that have to be used here, but when you look at percentage reductions, you see the AMRAAM stands out, it sets apart from the others because of the fact that you are coming down 91 percent.

Dr. COOPER. I will ask General Randolph—let me just point one other thing out on this, though, which is that there is no competi-

tion on Phoenix, no competition on Sparrow until later in the program. I don't know when—no competition directly on HARM, competition and producibility on AMRAAM. Those sorts of things have to be considered when you look at the learning curve.

While we are at it, Mr. Spratt, when you bring two guys on in the front end, you are going to expect to pay more in the front end because you are splitting the buy. You don't start to realize the benefits of competition until you go down the road. So it may be that AMRAAM is high on the first year relative to the others because we are bringing two producers on. All of those things we would have to look at, I guess, to normalize these curves to see whether or not they are reasonable.

Mr. SPRATT. That is the reason it seemed to me to be unprecedented, General Randolph.

General RANDOLPH. By the way, Mr. Spratt, I have heard the argument that this missile has an unprecedented learning curve. I will have to say that that is not the case. It might be unprecedented if you take this small set, but in terms of the airlaunched cruise missile, the learning curve was much more aggressive than in the case of the AMRAAM. If you recall, the airlaunched cruise missile was an extremely successful program.

I think the point Dr. Cooper made with regard to competition, it is my view this happens to be an extremely competitive area. Both of those contractors are most anxious to work in the air-to-air missile field, and both of those contractors have demonstrated in the past very aggressive competition, and we have no reason to believe that they are going to be any less aggressive in the case of AMRAAM.

Mr. SPRATT. What is your learning curve expectation on this program; what learning curve is required for the unit costs that you are projecting?

General FERGUSON. I would like to make another point, sir, the AMRAAM total learning curve is 81.4 percent. For comparison, the AIM-7F was 78.4. It is very difficult, I think——

Dr. COOPER. That doesn't reflect that when you look at Sparrow.

General FERGUSON. That is what I wanted to go into.

Dr. COOPER. The rates, Mr. Spratt, are what is missing here, whether or not you are buying as many Sparrows in a given year as you are buying AMRAAM's.

General FERGUSON. If you make your comparison on a recurring fly-away cost basis, which is I think the proper comparison to make with the Sparrow, Sparrow started off with two lots that were bought sole source, and then they went two lots split between the two contractors, and two lots that went to competition.

If you would make the same comparison with AMRAAM, which would be at the end of the fourth lot, where we have two lots in competition, two lots in direct competition between two contractors and two in competition, and you look at what was the percentage reduction in cost from the beginning to the end on the AIM-7, it turns out to be about 76 percent, and on AMRAAM, it turns out to be 84 percent. So we are slightly more aggressive in that regard, but it is not, I think, unprecedented.

Mr. SPRATT. What is the average unit cost going to be in the first and second production runs?

General FERGUSON. I don't have that number just offhand. It is obviously——

Mr. SPRATT. Our problem in dealing with your numbers is we don't know what are in the numbers.

General FERGUSON. I understand. The reason for saying that, the comparison really ought to be made, and I know it may be somewhat tiresome, but to make it on the fly-away cost basis, as I mentioned, is because we are paying a very, very significant penalty, I would say, but we derive the benefit of that penalty in the first two production lots where we are bringing two contractors on board to be prepared to compete.

Of course, we are not buying very large quantities, and so you could say that the overhead burden, in order to be able to compete and have the kind of cost reductions we think we will see in the future, that is a cost of doing business. So it drives up the apparent unit cost early.

Mr. COOPER. Let us get you those numbers for the record, Mr. Spratt.

[The following information was received for the record:]

## AMRAAM UNIT COST

The discussion centers on the AMRAAM learning curve analysis accomplished by Congressman Spratt's staff (Atch 1). We have examined those figures and offer a number of comments and analysis of our own to help clarify the AMRAAM unit cost situation.

There are a number of important differences between the missile production programs that need to be highlighted, as they significantly affect the learning curve comparisons. The AMRAAM production program has reflected in it all the normal front-end costs of starting a production line as well as the substantial costs associated with bringing on a follower contractor at the same time. In addition, there is the investment necessary to start the producibility enhancement (production cost reduction) program. The figures shown for the HARM program do contain front-end costs, but it is a sole source program without the early high costs of developing a second source. The SPARROW program does not have significant front end costs in that the existing AIM-7 production line only had to be modified for a new guidance unit that constituted the model change from AIM-7F to the AIM-7M. The PHOENIX program is difficult to address since it includes second source development costs well after program start (no second source yet in production) and includes certain nonrecurring fleet support costs throughout the program.

Therefore, in order to even roughly compare these programs at the procurement unit cost level, some normalization technique is necessary. Even then, differences in quantity and program content do not allow precise comparisons. Using the HASC data for comparison purposes, chart 1 below compares the procurement unit costs and the percent of initial unit costs for the three most similar programs (SPARROW, HARM, and AMRAAM). The comparison uses start points selected to eliminate, as much as possible, the distortion of dissimilar front-end costs. The chart shows that AMRAAM is not out of line with the other programs.

As further clarification, the AMRAAM program procurement strategy and budget estimates are patterned after the SPARROW missile (AIM-7F model). Because of this, we can identify and establish a more representative basis for analysis at the missile hardware level where recurring cost element trends can be isolated and computed. If the two programs are compared at the missile level through the second lot of competition (AMRAAM Lots III and IV), the unit cost in the SPARROW program decreased by 76 percent as compared to 84 percent for AMRAAM. This is very comparable when you consider that AMRAAM has 5,000 missiles under competition compared to 3,457 for the first two lots of competition for AIM-7.

Finally, use of a composite learning curve to derive the total year-by-year procurement funding levels is inappropriate. With AMRAAM, there are separate curves for each of the phases of production (directed split, initial competition, and stable competition including incorporation of producibility enhancements) for each contractor, and for each missile subsystem (for labor and material). However, it is appropriate and, in fact, general

practice to apply learning curve theory to derive recurring manufacturing cost. Cost improvement occurs as a result of increased production rates and, in our case, by application of producibility enhancements and competition. The collective benefits of all these items resulted in the composite AMRAAM learning curve. Chart 2 below shows the AMRAAM air vehicle recurring costs in FY 84 dollars for each production lot and for the total AF/USN buy. The 81.4 percent composite learning curve is a best-fit approximation which fits a single mathematical curve to the actual discontinuous curves derived in greater detail. These procedures are consistent with those used for developing detailed program cost estimates for other missile programs.

CHART 1

PROCUREMENT UNIT COST COMPARISON

(Unit Costs $ in Millions/% of Initial Unit Cost)

| | SPARROW[1] | | HARM[2] | | AMRAAM[3] | |
|---|---|---|---|---|---|---|
| PROCUREMENT YEAR | $ | % | $ | % | $ | % |
| 1st Year | .365 | 100 | .963 | 100 | .497 | 100 |
| 2nd Year | .249 | 68.2 | .604 | 62.7 | .303 | 61.0 |
| 3rd Year | .249 | 68.2 | .597 | 62.0 | .290 | 58.4 |
| 4th Year | .186 | 51.0 | .366 | 38.0 | .267 | 53.7 |
| 5th Year | .194 | 53.2 | .265 | 27.5 | .244 | 49.1 |
| 6th Year | .166 | 45.5 | .226 | 23.5 | .235 | 47.3 |
| 7th Year | .182 | 49.9 | .212 | 22.0 | .255 | 51.3 |
| 8th Year | .181 | 49.6 | .206 | 21.4 | .232 | 46.7 |
| 9th Year | .182 | 49.9 | .313 | 32.5 | | |
| 10th Year | .213 | 58.4 | | | | |
| 11th Year | .211 | 57.8 | | | | |

Notes:

1. SPARROW procurement figures begin with the first lot of AIM-7M production in FY 1980 as there was minimal front-end costs associated with transitioning the production line from AIM-7F.
2. HARM procurement figures begin with the second lot of production in FY 1982 to eliminate the distortion of the start-up costs included in the first lot.
3. AMRAAM procurement figures begin with the third lot production in FY 1989 to eliminate the distortion of the costs of starting up two contractors and instituting an aggressive cost reduction program in the first two lots.

CHART 2

AMRAAM AIR VEHICLE RECURRING COSTS

(FY 1984 DOLLARS IN MILLIONS)

| FY | LOT | QUANTITY | TOTAL COST | UNIT COST |
|---|---|---|---|---|
| 1987 | I | 260 | 301.89 | 1.161 |
| 1988 | II | 833 | 472.61 | .567 |
| 1989 | III | 2000 | 513.69 | .257 |
| 1990 | IV | 3000 | 563.31 | .188 |
| 1991 | V | 3000 | 514.06 | .171 |
| 1992 | VI | 3000 | 493.98 | .165 |
| 1993 | VII | 3000 | 484.31 | .161 |
| 1994 | VIII | 3000 | 477.12 | .159 |
| 1995 | IX | 3000 | 471.88 | .157 |
| 1996 | X | 3227 | 496.85 | .154 |
| TOTAL | | 24320 | 4789.70 | .197 |

Mr. SPRATT. I have some fly-away numbers here of 131,000 145,000, 166,000, and it came back down to 151,000 over the last— 1981, 1982, and 1985.

Dr. COOPER. That is the average cost over 17,000 missiles.

Mr. SPRATT. And not per production line, production run.

The second page just outlines in a different form the same point we were making on the first page, and if you take all of the costs incurred to date and derive a cumulative average cost, our derivation is 2.5 million on cumulative average cost for the Phoenix right now. As you see, that involves what is to me an apparently unprecedented production from cumulative average costs over the life of the program, down to the last procurement year, from 2.5 down to 0.232, from 2.5 million to 232,000 in a period of 10 years.

I know we are combining costs there, but still that seems to me to be a rather dramatic accomplishment on a program that has still got a lot of kinks to be worked out of it. Aren't there 20 modifications that need to be made in your producibility cost program?

General FERGUSON. Right now we anticipate we would have 27 projects, two-thirds of those projects would be contracted with the Raytheon Co., and of that 18, almost half will go to vendors, and then the balance or the 9 projects would be provided to the Hughes Aircraft Co.; and, once again, several of those would go to vendors.

Mr. SPRATT. Do we have costs negotiated associated with these producibility changes?

General FERGUSON. We have contractor proposals, but we are not now into the negotiation phase of that program, and we would expect to be awarding contracts between now and probably the end of May.

Dr. COOPER. But there are up-front costs associated with producibility.

Mr. SPRATT. They wouldn't be left undefinitized, the companies associated with these modifications would be definitized in the original contract, then?

Dr. COOPER. I am a little bit confused.

Mr. SPRATT. The 27 changes that need to be made to reduce the cost of the program——

Dr. COOPER. We will know those costs, yes.

Mr. SPRATT. They won't be subsequent modifications of the contract to take into account the cost reductions?

General RANDOLPH. Those numbers are included in the price.

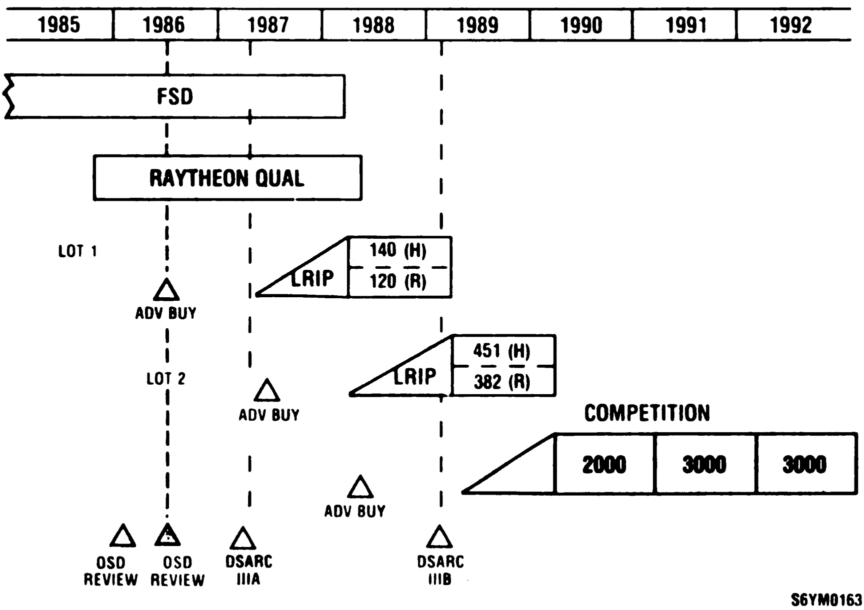
Mr. SPRATT. How much testing will remain after you have signed the production contract? What percentage of the testing program will remain after you have signed the production contract? How long a period of time, and what percentage of the program?

Dr. COOPER. While he is getting that, just to put the program in context, Mr. Spratt, we right now anticipate we will release long lead funding for the first lot sometime this summer. We will not actually go on contract for the full production option until sometime after the turn of next year. There is testing that remains after that point in time that we look at as a low-rate initial production phase. In fact, the first two phases are low-rate initial production phases.

Mr. SPRATT. As I understand, you will go through the first production run, the second and third production run, until you incorporate the producibility changes?

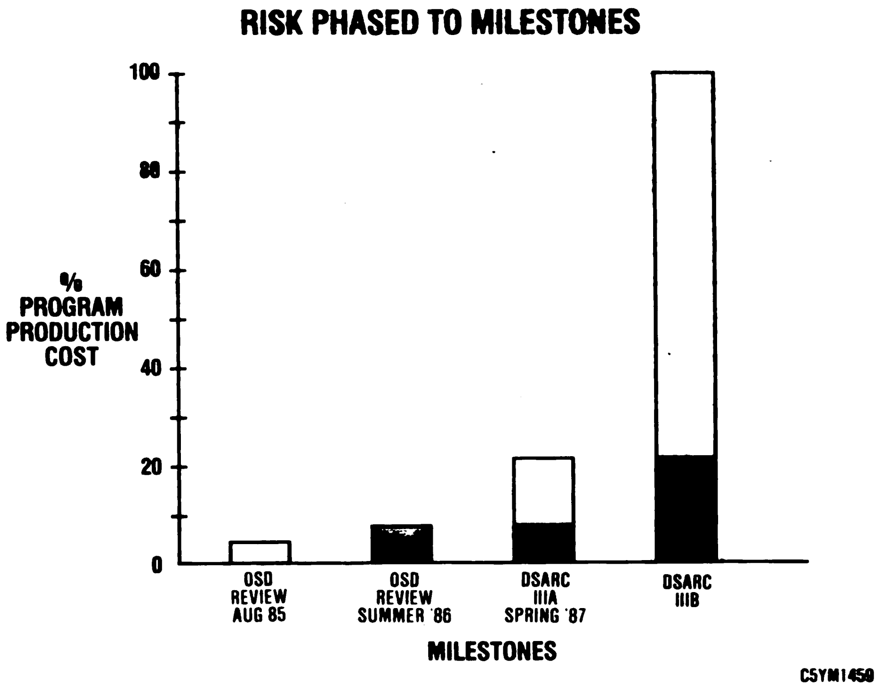
Dr. COOPER. They will be integrated throughout. It is not until we get to the fourth production option we have them fully well integrated.

## PRODUCTION PROGRAM




General FERGUSON. That is correct. Here is the full scale development activity. Raytheon's qualification program parallels it as far as completion. We are looking this summer, then, for the go-ahead for just the advanced buy portion of the lot 1, long lead, and, of course, at that point in time, we anticipate we will have a substantial evaluation. We are looking at a minimum there of something like 35 launches that would be complete by the time we get to the real decision to turn on lot 1 production.

Here we expect to have a minimum of eight missile launches, and, of course, we are well into our reliability and captive carry reliability efforts as well. We phase the FSD information commensurate with decision milestones to minimize our investment risks at each one of these milestones.




Let me show you on the next chart how we tried to do that. Of course, in our review process last year, you have essentially in the authorizations and appropriations bills last year approved the go-ahead of the Raytheon qualification in our producibility program. In total that represents—and all those funds aren't going to be spent at this point in time, are spent over approximately the next 3 or 4 years, that is a commitment of about 5 percent of our total production cost. Then we will hit another milestone this summer for the advanced buy, long lead, of about another 2 percent commitment over funds, and finally not until April of 1987, where it will actually make the decision for low-rate initial production.

At that point in time, as I mentioned, we will have a very good evaluation of a missile in flight test. We will ask for the funds for low-rate production. We are not committing to the large majority of production funds until we reach our third milestone, and that is following completion of all our development testing.

Mr. SPRATT. What confuses me is you are asking for a rather high rate of budget funding, $716 million this year and $867 million next year. Are you obligating large sums on the contract? Do you need all this money if you are keeping it at low-rate production?

General FERGUSON. The answer is yes, those funds are required in order to build those 260 missiles, and as I mentioned, those costs are magnified by bringing on two contractors on early at a fair rate of production.

General RANDOLPH. You have to have funds to get the tooling started up, to get the contractors on board, and that is typical of

any program. You spend a considerable amount of money on the front end and get very little product out.

Mr. SPRATT. I looked at the SAR, and the SAR indicates this program was behind on five of seven milestones. That was last year's SAR.

Dr. COOPER. The program has been restructured since last year's SAR. I would say in the test program, we are 29 months longer than the original schedule. We have restrengthened and lengthened it by 29 months, and everything has slipped accordingly about 2½ years.

General RANDOLPH. I need to make one point. From the November, 1982 SAR to the current SAR, the one that we are about to send over to you, maybe you already have it, there has been almost no change in the price tag associated with either the development or the production of this missile.

Mr. SPRATT. I also understand there have been 20 of 122 developmental missiles delivered and nine of these 20 missiles had to be returned to Hughes for corrections. Is that correct?

General FERGUSON. Yes, that is correct. I have already mentioned several of the aborts. Our separation control vehicles, both of those went out to the field and were successfully launched on the first time out. We have four missiles into a reliability, ground reliability test program. One of those came back prior to the time we got it into reliability testing.

However, I would point out that reliability testing is proceeding very well at the present time. We have plotted our first point on the reliability growth curve, and we are on target. We have had three missiles delivered for captive carry reliability tests, and those missiles have all experienced a problem prior to the time we actually got them into flight, I am sorry to say. Two missiles have gone to the Raytheon Co., one of those was returned, it is now back at the Raytheon Co., both missiles are working very well.

And as I mentioned in the film clip, the final assembly and checkout facility is in place, and training has been completed by Hughes Aircraft Co., and those employees have returned home, and Raytheon is proceeding. So I don't think the experience that we have had in the program, as far as missile returns, is unusual for where we are in the development program. It is something that bears very close watching, and there are no trends, in other words, there are no problems that seem to be repeating.

And, of course, we are identifying the corrective actions for all of these programs as we go along and have been successful in doing that so far.

Mr. SPRATT. As I understand, just summing up what you have said, the initial development contract was about 50 months, and it has slipped to about 72 months.

Dr. COOPER. Seventy-nine.

Mr. SPRATT. It is going to take approximately another 2 years to complete the design and integration of these 27 modifications into the missile.

Dr. COOPER. Not to complete the design of the missile.

Mr. SPRATT. I mean the whole process.

Dr. COOPER. We believe the basic design is essentially complete. Incorporating the producibility changes that will make that design cheaper to produce will take another couple years.

Mr. SPRATT. What would be the consequence if we said, "Here is some additional R&D money, complete the development program, come back to us with better results, a better handle on the design, the integration of these changes, and a better estimation of costs given the changes that have been made"? What happens if we do that for 1 year?

General RANDOLPH. No. 1, I think that is exactly where we are right now. We have a program that goes very slowly, until such time as those changes are in, but it is important to understand that when you do the missile, you want to test the production article. That is the purpose of lower rate initial production. We believe we have a reasonable lower rate initial production program whereby General Ferguson has shown we don't commit large dollars until those low-rate missiles have been produced. We want to be sure as they come off the production line, they do everything precisely as we expect them to do. We believe that going into the production program right now is done in a very orderly manner.

As you recall for fiscal year 1987, now we are just beginning to ask for some initial funds, so we aren't doing that in an aggressive manner at all, I think. One of the things we made sure we did was not get into a concurrency situation with this missile because we believe if we had asked the Secretary to certify under a concurrency situation, the situation would have been risky. So we purposely did not do that.

Dr. Cooper, talking about wire brushed, he wire brushed us to make sure our schedules were laid out so that concurrency was not a factor.

Dr. COOPER. We made that decision 2 years ago. January 30, 1984, we came up on a production decision for AMRAAM, and that is really what kind of got us to where we are today. We had fixed price production options in hand for the first two production options, and when we reviewed the program, we weren't ready to go into production, and we lost those fixed price production options.

We are 2½ years, I don't want to say behind schedule, but restructured in schedule from that point. That was the original point where we were supposed to make a production decision. We weren't far enough in the development program, there was too much concurrency in the program, and as a result, we slipped to 29 months.

What would happen is what happens to all programs when you slipped them a year, you get the capability a year later, and the cost goes up. We think the concurrency that is in the program right now is manageable.

And I would like to underscore the point that General Randolph made about going into low-rate initial production. Somehow people view that as being bad. I think it is important to start to get some missiles off the production line so we are not testing a hand-made article, so that we are testing missiles that are actually made on hard tooling. You can't get those missiles unless you go into low-rate initial production.

Mr. SPRATT. Is 260 missiles next year the rate of production you are going? Is that low rate?

Dr. COOPER. It is actually split.

General FERGUSON. You have to remember, that is split between two contractors.

Mr. SPRATT. 833 the next year, is that low-rate also?

Dr. COOPER. Yes, sir; and that is split between Raytheon and Hughes, again almost 50–50. Not quite.

Mr. SPRATT. In the contracts you execute, will you have options for future production runs that will assure you will achieve the average unit price the law requires?

General FERGUSON. We will have a negotiated, "not to exceed" for the following production lot. So, yes, that should guarantee we will see the kinds of price reductions, and, indeed, we do have commitments from both contractors and in letters providing "not to exceed" that would indicate we will see the kind of cost reductions that I have shown.

Mr. SPRATT. We won't fully—we won't have a contract with options out for all 17,123 missiles that will give us the full price protection. You are saying the curve will point in the right direction, but we won't have that locked in when we sign the contract?

General FERGUSON. That is correct.

Dr. COOPER. Let me tell you one of the options, I think, we have downstream. The way we want to keep leverage on the cost of this program is through competition. However, if downstream we get to the point where one contractor is clearly superior to the other in terms of both quality and cost and makes us an offer we can't refuse, where we can take advantage of a multiyear contract or something like that, that is an option the Government has. That is not our current plan.

Our current plan is to try to keep both Hughes and Raytheon going head to head for the full buy of 24,000 U.S. missiles, and there may even be others for the Europeans.

Mr. SPRATT. What I was saying was can you get the contractors right now to sign off on your cost estimate, our goal of $300,000 per unit, by the end of this program? And really we can't.

Dr. COOPER. We can get him to give us a number, but that would be contingent upon the Department and Congress agreeing to fund for 10 years at a certain rate.

Mr. SPRATT. Our cost estimates are contingent upon full funding and all those assumptions?

Dr. COOPER. Yes, sir, they absolutely are. If we break faith or cut the production rates, not unlike the B–1, then the deal is off.

General RANDOLPH. Mr. Spratt, I really believe if you believe in competition, you have to believe we are going to get a better deal by keeping the competitive pressure on it.

Mr. SPRATT. I agree, and we shouldn't criticize you when you dual source and then criticize you because you have extra costs at the outset of the program. We ought to understand the requirement there. Still I am dubious about the numbers, as you can see.

I wanted to facilitate these answers. Anything you can respond to for the record I would appreciate, particularly on the average unit cost. Thank you.

Dr. COOPER. Yes, sir. Mr. Spratt, don't let our support for AMRAAM lead you to believe we don't have concerns or a challenge in front of us. This is a challenging program to put that radar in the 7-inch cavity, and I fully expect we are going to have problems as we go through the test program. I don't know of any test program in the Air Force today, save MX, Mr. Mavroules, and I am going to knock on wood, that we don't have problems. That is the whole nature of the test business. You test, you analyze and you fix.

Mr. SPRATT. I understand that completely. The only question I am asking is should we rigorously test before we commit so much money to production and procurement?

Dr. COOPER. We think our program has the right balance in that regard. Mr. Chairman, if I could just point out one thing for the subcommittee, though, we have been on AMRAAM now for 10 years. The program got started in 1976. That was the year I joined the staff of the House Armed Services Committee. We had a competition originally with five contractors involved, we down selected to two, those two were Hughes and Raytheon. We then had another phase where we had a competition, Hughes won that, and we selected Hughes to go into full-scale development. We then brought Raytheon on as a second source.

We plan to have another competition for production. The program is joint in nature, the Navy is on board, it is international in its character, the Germans and British are very interested. We have got vigorous competition, as I mentioned.

There is a producibility program. Mr. Weinberger has capped the program, it is fully funded in our budget. I don't know any other acquisition tool that we have available to us that we are not using on the program, and I might just mention, if I don't embarrass him, I don't think there is a better program manager in the Air Force today in this business than Tom Ferguson. He has been on the program now for over a year, and I would be candid to admit, and I think I admitted to you, we had some problems with the program office a couple years ago. So I think the need is unquestioned.

I have used this number before. In 1988, when AMRAAM actually starts to enter our inventories, we will have $100 million of F-15's and F-16's on the ramp that are AMRAAM shooters. AMRAAM, in my view, represents our competitive edge. There is no doubt in my mind we have the best sensors in the world today in our aircraft. But it is essential that we keep the first-look/first-shot capability. We can see the other guy first, and we get to shoot him first, otherwise we lose the competitive edge that we have.

I think the investment that we are asking you to make, which is somewhere between $7 billion and $8 billion, to buy 17,000 AMRAAM's leverages that $100 billion investment that you have already made. And that is not to mention the advanced tactical fighter. The advanced tactical fighter the Air Force wants to produce for the late 1990's and the year 2000, if we don't have an AMRAAM-like capability, we might as well not produce it. It has to have the missile. You don't have air superiority unless you have the arrow to put in the bow. There are no alternatives that we see to AMRAAM.

The R&D programs are 95 percent complete as, I have said. We have been into it for 10 years now, and to think we would scrub this one and start another one up, I lose time, it costs more money, and we don't see it would give us additional capability.

I agree with you, there is an issue on affordability. We have brought that to you. All I can tell you is in some fairly tight budget terms, AMRAAM remains fully funded in the Air Force budget, and we intend to keep it that way. I strongly solicit your support for AMRAAM. It is not a sick program.

General RANDOLPH. May I just add to that, sir. From a military capability point of view, I would like to echo what Dr. Cooper said, that AMRAAM is absolutely critical. If you cancel this program, we will have to start another program, and, in effect, redo the whole thing, as Dr. Cooper has said, that has been 95-percent completed. But it is critical to our forces that we have this kind of a missile. And it is something General Russ, the Commander of the Tactical Air Command, considers at the top of his priority list. It is a very critical requirement.

Mr. STRATTON. Dr. Cooper, in line with what you have just said, I would suggest that perhaps you would give us some reports from time to time on exactly what you are doing to make this system well.

Dr. COOPER. We will be happy to keep you informed, Mr. Chairman. I will make a commitment to do that. As I say, I don't think the program is sick. I think the program is very well structured right now. Now that is again not to say there won't be challenges ahead of us. But we are four-for-four or five-for-five in the test program, and I might mention that one shot you saw where the drone was shot down, that was without a warhead. That was a direct hit. And I don't think any of us expected to have that much success early in this program.

I am very glad we have had that much success because my concern would be the first time we have a failure, someone is going to run out and say "Let's cancel the program." Again, that is the nature of the test business, that we go out to find problems, and I don't know how many shots we have left, Tom, 80 or 90? How many total?

General FERGUSON. Eighty-five.

Dr. COOPER. As we expand the envelope on AMRAAM, I will suspect we will run into problems, and we will have to go back and tweak the missile. That is the nature of our business.

Mr. STRATTON. I think if we did this in line with the statement of the GAO people, that might help it. For example, on page 3, they claim that the production cost of 17,000 missiles would require forecasting the future.

Dr. COOPER. I agree with that, Mr. Chairman.

Mr. STRATTON. And at the same time, they indicate that there is no legal basis for objecting to the release of the $54.4 million held in reserve. They indicate that there are uncertainties as to costs, scheduling and performance. The early flight test missiles have a number of deviations from contract specifications, which if not corrected could impair missile performance, and reduction changes, slippages, and finally a full-scale development ceiling of $556.6 mil-

very responsive, what is the bottom line? You indicated there are risks, all programs have risk, don't they?

Dr. COOPER. It is the nature of our business. I don't know of one program where we don't have risks.

Mr. MAVROULES. Where is the bottom line? Is there anything unusual about this missile we should be concerned about versus other programs?

Dr. COOPER. I am going to comment, and then I will get General Randolph to comment. If you had asked me the same line of questioning 2 years ago, and I think we came forward, I would have some grave reservations. I think the program today is a fundamentally sound program, and I think it has been realigned in a way we have an opportunity to do that. It is almost 50 percent longer in terms of its development phase. We went from 50 months to 79 months. In fact, that is more than 50 percent longer.

There was too much concurrency, we were too ambitious early on, but the program, the fundamental design of the AMRAAM missile has never been in question in our mind. We think it is a fundamentally good design, it was just the program was too ambitious, and I think also, our very early estimates of cost—and I was sitting on the other side of the dais at the time when the Air Force said they thought they could build this missile for $70,000 a copy in 1978 dollars. It was off the wall and extremely low, and we have admitted that.

But the cost that we brought forward to this committee for the last 4 years has been within a few percent of what we are telling you the cost is today. They had that one-time spike after we got through the proper program reviews, and they have stayed pretty well level. We think it is possible to do it at this time at $5.2 billion for 17,000 missiles, not without its challenge. I think the cap, itself, is going to be a tremendous club for us to use on the contractors. They now know where the goal line is, that coupled with the competition, I think, will be enormously helpful.

The requirement is unquestioned in the Air Force. It is as high a priority in the Air Force as I know in the tactical aircraft world.

Mr. MAVROULES. Very good.

Dr. COOPER. I urge you to go forward.

General RANDOLPH. I would like to add, I have been in the business of running programs for 20 years, I have run two major programs, and this program, as Dr. Cooper has said, has in the past been in trouble. But looking at the program in excruciating detail, which we all have because of the requirements of the Congress over the past 2 years, really, this program is in as strong a shape as any program that we have today. And that is regardless of which service that we have got.

We have got a top-notch program manager, we have got a baseline that is clear, we have contractors that are dedicated to succeeding, we have got competition, we have got all the tools you need to make sure you succeed. I can't imagine anything else that we can do to this program to make it stronger than it is right now.

Mr. MAVROULES. Thank you.

Mr. STRATTON. I want to thank you, gentlemen.

[The following questions were submitted to be answered for the record:]

GLOBAL POSITIONING SYSTEM

Question: The GPS request includes $10.1 million for contractor support for 8 Shuttle Navstar GPS launches. Does the Challenger tragedy change these plans?

Answer: The GPS launch schedule will change, however the initial launch date and launch rate have not yet been finalized. Our objective will be to establish the GPS satellite constellation as soon as feasible. Since it is not economically prudent to open the firm fixed price multiyear satellite production contract (this would nullify significant savings associated with the multiyear approach), funds now designated for near-term launch support will be required for temporary storage of satellites.

GPS SHUTTLE LAUNCH DATE

Question: Is it correct that the first Shuttle launch date has already slipped from the 1st Quarter/Fiscal Year 1986 to the 2nd Quarter/Fiscal Year 1987?

Answer: No. The first GPS production launch was originally scheduled for the first quarter of Fiscal Year 1987. An adjustment to the Shuttle schedule revised this to the second quarter of Fiscal Year 1987. The GPS multiyear satellite production contract remains on schedule and within cost.

GPS FUNDS TO SUPPORT ORIGINAL LAUNCH

Question: What, if any, funds were provided in Fiscal Year 1986 to support the original launch? What are your requirements for the funds?

Answer: A total of $8.4 million was programmed in Fiscal Year 1986 for launch support. These funds are required to support on-site test activities at the Eastern Launch Site and to establish long-term GPS launch support capabilities. The funds are not solely associated with the initial launch planned for the second quarter of Fiscal Year 1987 (previously planned for the first quarter of Fiscal Year 1987). Since GPS satellites will still be launched from the Shuttle, this requirement will not change despite adjustments to the Shuttle schedule.

DEFENSE SUPPORT PROGRAM

Question: The Air Force plans to initiate a multiyear procurement in Fiscal Year 1987 for 5 satellites for the DSP. As you recall, one of the criteria of multi-year procurements is stable funding. How does the Air Force intend to deal with Gramm-Rudman in this case?

Answer: Of the Fiscal Year 1987 missile procurement request for $358.5 million, $108.5 million is for non-multiyear items. We will attempt to take any potential Gramm-Rudman cuts by delaying non-multiyear items until FY 1988.

DEFENSE SUPPORT PROGRAM PROJECTED SAVINGS

Question: How are the projected savings of $319 million achieved? Is that in constant or then-year dollars? What precludes you from structuring an annual contract with priced options that achieve the same type of savings? What would be the funding request in Fiscal Year 1987 for an annual contract of this nature?

Answer: The projected savings are actually $329 million and are achieved as follows:

a. Inflation - lower impacts from inflation due to early buys of parts and materials. ($14 million)

b. Vendor/subcontractor - economic order quantities replace small-quantity lot buys. ($105 million)

c. Manufacturing - More efficient production by continuous production rather than the start-stop cycles caused by an annual buy. This encourages contractor investment in labor and tooling. ($210 million)

The $329 million savings is in then-year dollars. (The savings in Fiscal Year 1987 dollars is $274 million)

The rules of an annual procurement do not allow us to get the same economies of a multiyear procurement even with priced options unless the total quantity is bought up front. In an annual procurement the contractor cannot charge costs toward a satellite buy until the Congress authorizes that buy. Therefore, for the same economies, five satellites would have to be authorized in Fiscal Year 1988 with long-lead parts for five satellites in Fiscal Year 1987. Although no detailed analysis of this cost has been made, a rough estimate is that it would cost over $100 million more than the multiyear costs in Fiscal Year 1987 and over $500 million more in Fiscal Year 88. Multiyear procurement authorizes the start of work on all five units the first year but does not require nearly the same up-front investment. Therefore, the Fiscal Year 1987 funding request for an annual contract of this nature would be approximately $458.5 million ($350 million for long-lead for 5 satellites plus $108.5 million for other requirements.)

LASER CROSSLINK EFFORT

Question: Has there been any delay in the program because of cost growth in the laser crosslink effort? If so, how much delay? How much cost growth has been encountered with the laser crosslink effort? Has the program stabilized?

Answer: There has been schedule delay and cost growth in the laser crosslink program due to development difficulties early in the program.

These problems delayed the entire crosslink schedule by one year resulting in a one year delay in its originally projected initial capability.

There has been no cost growth since the production contract was signed in April 1984. There was growth from the original production estimate, made early in the development phase. That growth (both RDT&E and procurement) was about $150 million.

The development difficulties were overcome in 1983, the program was stabilized, and production has been going well.

DEFENSE MOBILE GROUND SYSTEM

Question: The General Accounting Office issued a report in September 1985 on the Department of Defense Mobile Ground System. For Fiscal Year 1987, the Air Force is requesting $100.0 million for this program. Have the difficulties cited in the GAO report been resolved?

Answer: All of the problems creating the difficulties cited in the GAO report have been identified and almost all have been corrected. Correction for the last few items will be initiated in mid-April and should be completed by the following month.

DEFENSE MOBILE GROUND SYSTEM FUND STATUS

Question: What is the status of funds authorized and appropriated in Fiscal Years 1985 and 1986 for this program?

Answer: The status is as follows:

a. Fiscal Year 1985

| | |
|---|---|
| RDT&E | 100% obligated |
| OPAF | 67% obligated |

The remainder is to be obligated by July 1986.

b. Fiscal Year 1986

| | |
|---|---|
| RDT&E | 50% obligated |
| OPAF | 30% obligated |

The remainder of the RDT&E will be obligated after final contract negotiations and the rest of the OPAF will be obligated by November 1986.

INTEGRATED TESTS OF MOBILE GROUND SYSTEM

Question: Has the Air Force undertaken any integrated tests to demonstrate the operational effectiveness or military use of the mobile ground system?

Answer: Yes, the initial operational test and evaluation began September 30, 1985, and will be completed in March 1986. To date the system has performed extremely well and has clearly demonstrated military effectiveness and suitability.

GAO DSP REPORT

Question: The General Accounting Office issued a September 1985 report in the Defense Support Program. What near-term and long-term efforts have been made to resolve the issues identified in the report? Does the new multi-year proposal incorporate these changes?

Answer: In the near-term, we are resolving most of the survivability and approximately half of the capability issues through the Sensor Evolutionary Development, the Mobile Ground System, an on-orbit spare satellite, and the new generation DSP-I satellites. [deleted] The new multi-year proposal continues the procurement of the new generation DSP-I satellites which were first procured in 1982. Therefore, the new multi-year satellites will incorporate all of the DSP-I survivability and capability enhancements.

SPACE DEFENSE SYSTEMS (ASAT)

Question: The Air Force is requesting $28.5 million in Fiscal Year 1987 in advance procurement for the ASAT program. It is my further understanding that plans are being made to initiate a multi-year procurement in Fiscal Year 1988 for this program. Aside from the arms control issues that have been raised with this program, what can you tell us about the status of the program?

Answer: As documented in the FY 1987 President's Budget, the ASAT program has undergone a major restructuring. The new program is based upon the results of an Independent Review directed by the Under Secretary of the Air Force last year and several previous recommendations by Congress. We have incorporated a production transition phase to make the system more producible, supportable, and operable. The program has also been divided into near-term and far-term phases. In the first phase, responding to the threat

through the mid-1990s, DELETED will be procured over FYs 1988-1992. The $28.5 million in advance procurement being requested supports a buy of DELETED in FY 1988. We are also planning to initiate a multi-year procurement for the remaining DELETED . A decision on the force structure for the second phase will be made in the FY 1990/1991 time period. At that point, in addition to reassessing the capabilities of the current ASAT missile, we plan to evaluate the maturity of other technologies that could be used to provide an ASAT capability. The far-term force structure may consist of additional ASAT missiles, upgraded ASAT missiles, other technologies, or a combination thereof.

P.L. 99-190 restricts the Air Force from using FY 1986 or prior year funds to test against an object in space. We have conducted a detailed evaluation of several alternate testing approaches which would obtain essential development data and make the best use of the appropriated FY 1986 RDT&E funding. Our preferred approach consists of conducting two flight tests against the radiation of a star. We had already planned a flight of this type prior to the moratorium to assess the low altitude performance of the sensor in the miniature homing vehicle. OSD is currently assessing the alternatives, and we expect to have a decision shortly.

F-15 SPECIAL ADJUSTMENTS FOR ASAT

Question: For example, is it correct that without special adjustments the F-15 aircraft has difficulty reaching the desired altitudes? Is it correct that the adjustments to the F-15 would result in engine wear and thereby reduce the engine life?

Answer: The present F-15 engines are adequate to meet the near-term threat (through the mid-1990s as defined by the Independent Review completed last year) with no special adjustments.

DELETED This may create a problem since engine teardown is required if this switch is employed and certain parameters are exceeded. To date we have not exceeded any of these parameters in the test program. We are evaluating an on-going engine improvement effort to determine the feasibility of installing upgraded engines on the specific models of the F-15 which will carry the ASAT missile.

MINIATURE HOMING VEHICLE

Question: What have you determined about the shelf-life of the miniature homing vehicle?

Answer: The specified shelf-life of the miniature homing vehicle (MV) is DELETED As part of the restructured ASAT program documented in the FY 1987 President's Budget, we have incorporated a production transition phase called Production Verification (PV). During PV we will conduct a series of comprehensive reliability and maintainability demonstrations to assess the supportability and suitability of the missile system. These tests will help to confirm the shelf-life of the MV.

CONTROL CENTER - ASAT

Question: Is it correct that $2.0 million included in the Air Force other procurement account is for support equipment for a control center?

Answer: No. The $2.0 million being requested is to procure a security system to protect the ASAT operational facility at

the C-17 is $7.48 million per aircraft (constant FY 85 dollars) based on 1397 flying hours per year.

The C-17 does not have a planned percentage of time that it will be used in intratheater roles. The demand will determine what mission the C-17 will perform. If the priority is for intertheater airlift then the C-17 will augment our strategic aircraft (C-141, KC-10, C-5 and Civil Reserve Air Fleet aircraft). If the priority is intratheater airlift then the C-17 will augment our C-130 aircraft. The advantage the C-17 provides is that flexibility to use the aircraft in whatever role has the highest priority based on the current situation.

ADVANCED TACTICAL AIRCRAFT IN LIEU OF THE F-15E

Question: Has the Air Force considered using the Advanced Tactical Aircraft in lieu of the F-15E?

Answer: The Air Force has not considered using the Advanced Tactical Aircraft (ATA) in lieu of the F-15E. Procurement of the F-15E begins in FY 86. The buy will be complete in FY 94. The first ATAs would not be available to the Air Force until FY 94. The need for an aircraft to augment the F-111 in the interdiction role is present today. The F-15E is being procured to fill that need. The Air Force will evaluate the ATA as a follow-on aircraft for the close air support/interdiction mission under the recently signed Memorandum of Understanding on cross-utilization of the ATF and ATA.

TOTAL PROGRAM COST OF THE F-15E

Question: What is the total program cost of the F-15E/--RDT&E? -- Procurement? -- Total procurement unit cost?

Answer: Total program cost and procurement cost are not available for only the F-15E portion of the F-15 program. In addition to procurement of F-15E aircraft, requested F-15 program funds will procure data, training equipment, depot support equipment, etc., which support all models of the F-15. RDT&E funds also support not only development and testing of changes required for the F-15E mission but also improvements to basic F-15 capability. Total F-15 costs for 1266 F-15A,B,C,D, and E aircraft are:

(Then year dollars in millions)

| | |
|---|---|
| Total program cost: | 38,470.3 |
| Total RDT&E cost: | 3,288.9 |
| Total procurement cost: | 35,181.4 |
| Procurement unit cost: | 27.8 |

The total recurring flyaway cost to procure 392 F-15E aircraft is $13,588.5 million. The total RDT&E cost to develop and test the changes required only for the F-15E unique mission is $293.9 million.

FB-111 TO TAC

Question: It is correct that the FB-111 may be transferred to the Tactical Air Command? If so, what, if any, impact does this transfer have on the F-15E requirements?

Answer: Yes, the Air Force is looking at the option to augment its F-111A/D/E/F force in the interdiction role. The transfer of FB-111s to the Tactical Air Force will have no impact on F-15E requirements. The present F-15E procurement program is less than DELETED of the stated USAF requirement and the addition of DELETED FB-111s will still leave us far short of our stated requirements.

F-15E STANDOFF CAPABILITIES

Question: What is the Air Force doing about developing standoff capabilities to perform the F-15E mission?

Answer: The Air Force plans to develop a series of conventional standoff weapons to enhance the lethality and improve the survivability of all tactical aircraft, including the F-15E. Air-launched standoff weapons will complement, not replace, planned force structure. Procurement objectives for future standoff weapons will consider planned force structure and projected inventories of direct attack weapons. They will improve combat capability significantly by allowing aircrews to avoid threats in the target area and in some cases, FEBA threats as well. Standoff weapons will also be used to roll back defenses allowing for the complementary use of less costly direct attack weapons. Newer generation aircraft, like the F-15E, with their extremely accurate fire control systems provide increased leverage for the large existing inventory of direct attack weapons after defenses are rolled back. The AGM-130 is the first in a planned series of weapons that will be compatible with the F-15E.

F-15 SPECIFIC TARGETS

Question: What specific targets is the F-15E designed to attack?

Answer: The F-15E is a dual-role fighter, capable of attacking any target in the air to surface or air to air mission area. Because of its long range and large payload capability it is primarily intended to augment the F-111 force in deep interdiction and offensive counter air, attacking lines of communication, supply points, rear echelon equipment and troop concentrations, airfields, and other appropriate targets. The F-15E can also be used in a secondary role to augment other fighters in Theater Air Defense.

F-15E BASING

Question: Where will the F-15E be based?

Answer: The initial beddown location for the F-15E will be a training unit at Luke AFB, Arizona. The beddown of operational F-15E units is still under discussion, and no decisions have yet been made on specific bases. The Air Force is currently planning for two operational wings in the CONUS, one in USAFE and one in PACAF.

F-16C AND F-16CM PROGRAM LINES

Question: The F-16 program is broken out into two lines in the fiscal year 1987 request--the F-16C and the F-16CM. What is the basis for this breakout? How does it affect the current multiyear program?

Answer: The basis for the breakout is the fire control radar. The F-16C aircraft is equipped with an APG-68 radar. The F-16C referred to as an F-16CM in this information request is equipped with an APG-66 radar. The Government will procure both radars on an annual contractual basis and provide them as Government Furnished Equipment to the prime contractor for integration according to an

agreed schedule. There will be minimal perturbation to Multiyear Procurement II.

WHAT IS THE F-16CM

Question: What is the F-16CM? How does it differ in cost and performance from the F-16C? What will it be used for?

Answer: The F-16C referred to as an F-16CM in this information request is equipped with the APG-66 radar instead of the more capable, but more expensive, APG-68 radar. Regarding performance, the APG-68-equipped F-16Cs have an enhanced air-to-air and air-to-ground mission performance capability over the APG-66-equipped F-16Cs. This APG-66-equipped F-16C costs about one million dollars less on average than the APG-68-equipped F-16Cs for the period FY 1987 through FY 1991. Many of the APG-66-equipped F-16Cs will be LANTIRN-primary aircraft, but all will retain a multi-mission capability.

FEASIBILITY OF COMPETING THE F-16CM

Question: Have you considered the possibility or feasibility of competing the F-16CM in fiscal year 1988, either in terms of another aircraft or a second producer?

Answer: The Air Force has considered the entire gamut of fighter aircraft missions to introduce competition into the F-16 program. The Air Defense Fighter Competition has been the most promising candidate. However, as the F-16 program has matured, strong competition has been built into both the Government Furnished Equipment (GFE) and the Contractor Furnished Equipment (CFE) buys to ensure the most airplane for the dollar. In fact, 77 percent of the GFE is competed, and 85 percent of the CFE is competed. In total, 63 percent of the F-16 is already competed. No further competitive programs, based on a missionized segment of the multiyear procurement core through FY 1989, would be beneficial to the taxpayer at this time. However, the Air Force continuously manages mission requirements with its weapon systems, and will introduce further competition where cost savings can be achieved while meeting Air Force requirements.

F-16 APG-66 RADAR-BLOCK PROGRAM COST

Question: What is the total program cost, buy and schedule for the F-16CM?

Answer: The program cost of the F-16C referred to in this insert is a fractional estimate within the total F-16C/D procurement budget. "F-16CM" is not a designation recognized in the Air Force; nor does it have any meaning in terms of configuration. We believe that the term "F-16CM" refers to F-16 APG-66 Radar Block Program which is an evolutionary block change from the current baselined F-16C/D. The numbers are budgetary in nature and do not necessarily dictate a certain configuration. For example, at this time the Air Force has firm requirements for only 350 F-16Cs which are equipped with the APG-66 radar (vice AGP-68). Therefore, other actions might have to be taken to reduce costs. The recurring flyaway and peculiar support cost schedule extracted from the FY 1987 President's Budget is summarized as follows (TY$ in millions): ____________

| "F-16 APG-66 Radar-Block" Program | FY87 | FY88 | FY89 | FY90 | FY91 | To Complete | Total |
|---|---|---|---|---|---|---|---|
| Quantities | (120) | (120) | (120) | (120) | (120) | (360) | (960) |
| Recurring Flyaway | 1473.9 | 1693.3 | 1828.1 | 1782.6 | 1837.7 | 5878.2 | 14493.8 |
| Peculiar Ground Support Equipment (organizational and intermediate) | 73.5 | 122.5 | 142.3 | 164.4 | 182.9 | 666.6 | 1352.2 |
| Total | 1547.4 | 1815.8 | 1970.4 | 1947.0 | 2020.6 | 6544.8 | 15846.0 |

Notes: (1) These cost estimates assume an aggregate F-16C/D program of 216 aircraft per year. The nonrecurring, data, and depot-level peculiar ground support equipment cost elements are excluded from these costs as they pertain to the F-16 aircraft program as a whole. (2) Normally, F-16 aircraft deliveries commence 20 months from the beginning of the fiscal year in which they are procured.

AIR FORCE ONE PROGRAM COSTS

Question: What is the total program cost for the 2 Air Force One aircraft?

-- R & D?
-- Procurement?

Answer: The total program costs for the two Air Force One replacement aircraft are as follows:

| | FY 86 | FY 87 | FY 88 | FY 89 | FY 90 | TOTAL |
|---|---|---|---|---|---|---|
| R&D | 19.5 | 9.0 | 12.7 | .2 | - | 41.4 |
| PROCUREMENT | | | | | | |
| Weapon system | 280.0 | - | - | - | - | 280.0 |
| Support Rqmts | - | 34.5 | - | - | - | 34.5 |
| Initial Spares | - | 39.9 | 7.4 | - | - | 47.3 |
| TOTAL | 299.5 | 83.4 | 20.1 | .2 | - | 403.2 |

AIR FORCE ONE CONTRACT

Question: Why is it necessary to award a contract in May, 1986?

Answer: We must award a contract by May 1986 in order to retain competition. Competition is critical to this program in terms of reducing costs and maintaining public confidence in Department of Defense procurement. After May 1986, competition will not be available.

AIR FORCE ONE REPLACEMENT PROGRAM

Question: What precludes the Air Force from starting their Air Force One replacement program in fiscal year 1987?

Answer: The program must be started by May 1986 in order to have competition. We believe competition is critical to this program in terms of reducing costs and maintaining public confidence in Department of Defense procurement.

AIR FORCE ONE COMPETITION

Question: Is it correct that if the DC-10 wins the competition that the Air Force would buy two of the KC-10 aircraft that are on the current production line for the Air Force One program and then buy two KC-10s to replace them?

Answer: If McDonnell Douglas should win the competition, they will use two of the final KC-10 production slots to produce the Air Force One replacement aircraft and deliver the last two KC-10s at a later date.

Question: If this is the case, why is it necessary to award a contract in May of this year?

Answer: In order for McDonnell Douglas to compete, they must be on contract not later than May 1986 in order to phase in the changes in the DC/KC-10 production line for unique Air Force One requirements and still permit replacement of the two deferred KC-10s.

ACQUISTION STRATEGY

Question: Mr. Secretary, the Navy recently testified before the subcommittee on its new acquisition strategy that stressed fixed-price contracts, contractor investment in tooling and competition, particularly with respect to aircraft. Has the Air Force examined this policy and, if so, what conclusions have you developed? What is the Air Force's view of this strategy? Is it feasible? If not, why?

Answer: The Air Force has long been the leader in innovative acquisition strategy development. In the early 70's we used competition and "fly before you buy." In our Light Weight Fighter program we developed two prototypes. One became our F-16 and the other was picked up by the Navy for their F/A-18. Today, we're still using competition extensively. For example, in our Advanced Tactical Fighter program, we've got seven major aircraft companies each designing their version. We'll pick the best ones and develop them further. In another example, we're using competition with our aircraft engines and saving the taxpayers millions of dollars. By the way, in 1985 less than 13% of our dollars were awarded non-competitively -- the lowest in DOD. We developed the concept of the "leader-follower" acquisition strategy. This allows us to reintroduce competition during production of weapons systems where it make sense. For at least seven years we've been emphasizing fixed priced contracting. In 1985, over 85% of our dollars were awarded on fixed-priced contracts -- again the best in DOD. We developed the concept of multiyear procurement and have saved the taxpayers billions of dollars using it. If some

**one else develops a strategy that makes sense to us we'll adopt it. And as we develop and refine new approaches we'll gladly share our experience.**

UNOBLIGATED BALANCES

Question: For the record, please provide the current status of unobligated funds and the expected balances at the end of fiscal year 1986 for Air Force procurement programs.

Answer: The following table shows unobligated balances by appropriations for the period ending 31 January 1986 and estimated balances for the end of FY 1986. These amounts include all program years available for new obligations during FY 1986.

($ in thousands)

| Appropriation | Unobligated Balances (31 Jan 86) | Estimated Balances (30 Sep 86) |
|---|---|---|
| Aircraft Procurement AF | 23,790,442 | 10,135,195 |
| Missile Procurement AF | 9,598,008 | 3,382,192 |
| Other Procurement AF | 9,171,122 | 3,173,314 |

MULTIYEAR CONTRACT PROPOSALS

Question: For the record, please identify all of the new Air Force multiyear contract proposals that would start in fiscal year 1987.

Answer: The Air Force is seeking Congressional support for the formal approval of two multiyear efforts in FY 1987. The first is the initiation of the Defense Support Program (DSP) satellite multiyear contract for 5 units. We expect to save $330M through the use of multiyear contracting for this critical space system. This represents a reduction of almost 20% in the acquisition cost of these satellites.

In addition to DSP, we will also seek formal multiyear approval of the Complementary Expendable Launch Vehicle (CELV) program in the FY87 Authorization and Appropriation Bills. We have recently (7 Mar 86) requested authority to convert the current contract for CELV to an expanded advance procurement contract during FY86. This action, if approved, will set the stage for full multiyear approval in FY87. The CELV multiyear contract covers 10 boosters and will save $380M. This is a reduction of 22% from the annual buy acquisition cost of these boosters.

HH-60

Question: The Air Force has cancelled the HH-60A helicopter program. What is the status of the funds that were authorized and appropriated in fiscal year 1986?

Answer: The fiscal year 1986 R&D funds were used to complete the development flight testing of the peculiar MC-130H avionics on the HH-60A. We are requesting to reprogram all fiscal year 1986 HH-60A procurement funds into the MC-130H program to help accelerate that program and satisfy Congressional desires.

Question: What was the basis for the cancellation?

Answer: The HH-60A program was cancelled due to budget constraints and competing priorities.

Question: What is the Air Force's position on the HH-60A becoming a joint program with the Army?

Answer: While we support maximum use of HH-60A development for the Army's MH-60X, fiscal constraints preclude our procurement of that vehicle. We are continuing to evaluate our combat rescue requirements and will monitor the Army's program for possible future application to our needs.

MAVERICK

Question: There has been considerable discussion about the performance of the infrared Maverick. Also, there have been significant issues involving quality control. What have the test results to date demonstrated with regard to the missile's performance as measured against its specifications? What is the status of the quality control improvements program? Are there any issues that have not been resolved?

Answer: Test results to date have demonstrated that the AGM-65D, IIR Maverick missile, has met or exceeded every performance specification requirement.

All IIR Maverick quality issues have been resolved. The Quality Improvement Program originally included 477 key completion milestones of which 13 were Maverick-specific. Of the original 477, only 18 remain open at this time. None of these 18 items are Maverick milestones. These 18 open milestones are long-term and related to the project 1990's plant-wide factory modernization program.

AMRAAM CERTIFICATION

Question: As you know, the General Accounting Office issued an interim report dated Feb. 18, 1986 on the AMRAAM certification that reviews the elements of the certification. Those elements include status of design, system performance, flight testing and qualification of cost reduction design changes, a research and development performance standards. I have a series of questions to ask about the report and the subsequent certification. How many successful live launch tests have been made? How many are scheduled to be made and what is the schedule for those tests? Does the additional information provide for the possibility of later changes to the program? Does the additional information raise the production cost cap to $7.0 billion?

Answer: All six AMRAAM live launches to date have successfully met the test objectives. Two of these were unguided flights and four were guided. The total full scale development (FSD) flight test program consists of 97 missile launches comprised of 90 guided and seven unguided launches. The remaining launches will continue in 1986 and 1987, and finish approximately April 1988. The information obtained during the test program will be used to refine the missile design. These refinements are not expected to significantly alter the basic missile design to which the Secretary of Defense has certified and therefore, does not amend, modify, or change that certification. These design refinements will be in-

corporated and tested within the FSD program and will not impact flight test program iwll not raise the production cost cap. The $7.0 billion (FY 84 dollars) referred to is for the combined Air Force/Navy total of 24,000 missiles of which $5.2 billion (FY 84 dollars) is for the Air Force's 17,000 missiles.

## AMRAAM DESIGN CHANGES

**Question: Is it correct that design changes may be made as a result of further tests that will be designed to reduce costs? Is it correct that such changes will not affect performance? What is the basis for that statement? What are the additional changes that may be made? Why would they be made? When would they be made? What would be the costs associated with these changes? Who would pay for those changes.**

**Answer: There will be design refinements resulting from the AMRAAM flight test program; however, they will not significantly alter the basic design that the Secretary of Defense has certified. The design changes proposed to reduce production costs are those planned in the AMRAAM Producibility Enhancement Program (APREP). These changes will conform to the current form, fit, and function of the existing missile components. This means that the missile will not know that there is any difference between the original components and the APREP components. There will be no performance degradations as a result of the APREP changes.**

**The Air Force selected the following proposals from the two contractors because they believe they will have the greatest payoff potential:**

**Radar Frequency (RF) Processor**
**Inertial Reference Unit**
**Seeker Sum and Difference**
**Control Fins**
**Radome**
**Traveling Wave Tube**
**Actuator**
**TDD Electronics/RF Head**
**Filter Processor**
**Transmitter/Electronic Control Unit (ECU)**
**Digital Range Correlator**
**AMRAAM Data Processor**
**Rocket Motor**
**Seeker Gyro**
**Seeker Antenna**
**Target Detection Device (TDD) Antenna**
**Safe and Arm**
**Control Section**
**Remote Terminal**
**Microwave Assembly**
**Input/Output Device**
**Intermediate Frequency (IF) Receiver**
**Analog Range Correlator**

**The APREP changes are an integral part of the overall production cost reduction effort that resulted in the cost cap of $5.2 billion (FY 84 dollars) for the Air Force's 17,000 missiles ($7.0 billion for the combined Air Force/Navy quantity of 24,000 missiles). The Air Force expects to award contracts to both Hughes and Raytheon to start the design effort for the APREP projects by May 1986. The plan is to incorporate these into production Lots III and IV (FY 1989 and 1990 procurements respectively). The Air Force has estimated that it will invest approximately $268 million (FY 84 dollars) to obtain savings of approximately $1.55 to $1.66 billion (FY 84 dollars) over the life of the program.**

## AMRAAM CHANGES ON PERFORMANCE

**Question: What would be the impact of those changes on performance? What would be the impact of those changes on schedule**

and production? Is it correct that it will take two years to design and qualify the proposed cost reduction changes and possibly another year to fabricate and integrate the changes in the manufacturing process?

Answer: The design changes referenced are those planned in the AMRAAM Producibility Enhancement Program (APREP). These changes will conform to the current form, fit, and function of the existing missile components. This means that the missile will not know that there is any difference between the original components and the APREP components. There will be no performance degradations as a result of the APREP changes. These changes will not impact schedule or production as the changes will be phased into the production lines in an orderly fashion with a "block change" approach. It is true that it will nominally take about two years to design and qualify the APREP changes for incorporation into production the following year. The Air Force expects to award contracts to both Hughes and Raytheon to start the design effort for the APREP projects by May 1986. The plan is to incorporate these into production Lots III and IV (FY 1989 and 1990 procurements respectively).

HUGHES AMRAAM MANUFACTURING

Question: Is it correct that Hughes has encountered manufacturing problems with certain guidance system components? If so, when will those problems be resolved? Can you produce 17,123 missiles for $5.2 billion in fiscal year 1984 dollars with the current AMRAAM design?

Answer: There have been no significant manufacturing problems with the AMRAAM missile. Early units were built at the contractor's research and development facility and later units are being built at his production facility. Normal transition problems have been experienced in integrating the hardware into an all-up-round (a missile), but these are expected at this stage of the program. There are only two components which have not transitioned to the manufacturing facility. The two components are the input-output and receiver/range correlator chassis. The transition of the input/output chassis was held so producibility improvements could be implemented. This chassis will be fully produced at Tucson by Sep 86. Receiver/range correlator chassis transition was held so improvements in producibility, including shielding and grounding, could be made. This chassis will be transitioned to Tucson in Oct 86.

The Air Force believes that we can procure 17,108 missiles for $5.2 billion (FY 84 dollars) provided the Navy also buys 7,212 missiles as planned. This joint production program is estimated to cost $7.0 billion (FY 84 dollars). A basic assumption for being able to buy this quantity of missiles at these prices is the AMRAAM Producibility Enhancement Program (APREP). APREP consists of a number of projects by the leader and follower contractors designed to make the missile more producible. Some of these projects will result in changes that conform to the current form, fit and function design of the missile. These projects are expected to significantly reduce production costs on the order of approximately $1.55 billion to $1.66 billion (FY 84 dollars) for an investment of approximately $268 million (FY 84 dollars).

## AMRAAM DEVIATIONS

Question: Is it correct that a number of deviations involving radar launch time, guard antenna and temperature specifications have been found in the test missile? Have they been fixed? If not, when will they be fixed? Why are they considered minor or acceptable?

Answer: There are a number of areas where the test missiles, to date, have deviations from the contract specifications (those noted above are included). These were not discovered during testing, but rather were the result of early hardware being somewhat off nominal. All deviations were known before flight hardware fabrication started, and there was a conscious decision process to decide whether to include the particular hardware in flight missiles, as well as how to handle the deviation when the hardware is included in flight missiles.

Corrective design action for all known hardware deviations that impact performance has been completed. The redesigned hardware is in various stages of the design proofing process. Incorporation dates for each hardware fix have been identified. Corrective action started early in Dec 85. The deviations are considered minor or acceptable because they either:

1. Did not impact the objective of the particular test, and the fix would be included in the flight hardware before objectives of later tests would be influenced; or

2. The deviation, although not meeting a specification at a lower level, does not degrade system performance. It should be noted that the "deviations" are to the contractor's baseline and are temporary. No deviations to the government requirements have been made.

## AMRAAM RELAXED REQUIREMENT

Question: Is it correct that in the case of launch times, the requirement will be relaxed?

Answer: The AMRAAM launch-to-eject (LTE) time (the time it takes for first missile motion after the pilot presses the launch switch) is a function of aircraft and missile capability. The original requirement was DELETED DELETED The current estimate and the approved requirement is DELETED DELETED This point was reviewed by the Tactical Air Command and the AMRAAM Operational Requirements Review Group (chaired by the Vice Chief of Staff of the Air Force and the Vice Chief of Naval Operations) in Jan 85. They concluded that the LTE time was operationally acceptable.

## AMRAAM TEST FLIGHTS

Question: What is the number of remaining test flights that are scheduled to evaluate systems performance?

Answer: There are 91 launches (86 guided and five unguided) remaining in the development test and evaluation/initial operational test and evaluation (DT&E/IOT&E) program which will be used to evaluate missile performance.

## AMRAAM DESIGN CHANGES

Question: What is the reason for the delay in implementing the cost reduction design changes until 1989 and 1990? What are the cost reduction changes and the savings attributed to them?

Answer: The delay in implementing the cost reduction design changes until 1989 (Lot I) and 1990 (Lot II) is to allow the Air Force to pursue an orderly program to design and test the changes before they are integrated into the production configuration. The Air Force will direct an effort with both contractors that produces a design; construction of a bread/brass board; proof of design; proof of manufacture; and laboratory, captive carry, reliability, and flight tests, all prior to approval of the engineering change proposals necessary for the change to enter production. The cost reduction changes selected are as follow:

| | |
|---|---|
| Radar Frequency (RF) Processor | Rocket Motor |
| Inertial Reference Unit | Seeker Gyro |
| Seeker Sum and Difference Unit | Seeker Antenna |
| Control Fins | Target Detection Device (TDD) Antenna |
| Radome | Safe and Arm Device |
| Traveling Wave Tube | Control Section |
| Actuator | Remote Terminal |
| TDD Electronics/RF Head | Microwave Assembly |
| Filter Processor | Input/Output Device |
| Transmitter/Electronic Control Unit | Intermediate Frequency (IF) Receiver |
| Digital Range Correlator | Analog Range Correlator |
| AMRAAM Data Processor | |

The Air Force expects to see savings of approximately $1.55 to $1.66 billion (FY 1984 dollars) over the life of the program due to these changes.

## AMRAAM NEGOTIATIONS

Question: What is the status of the negotiations?

Answer: Negotiations for the AMRAAM Producibility Enhancement Program (APREP) are progressing very well. Definitive statements of work and terms and conditions have been established for each project. Price negotiations/fact-finding are being actively pursued with both contractors for 26 projects (18 Raytheon/8 Hughes). The first 14 projects are expected to be put on contract in mid-April 1986, with the remaining projects to be awarded in May 1986.

## AMRAAM COST OF CHANGES

Question: Who bears the cost of those changes? Do the reductions include any tooling and facilitization costs? Do you agree with the Navy that contractors bear little or no risk in defense procurement and should bear tooling and manufacturing costs?

Answer: The government, prime contractors, and vendor base all share in the cost of introducing AMRAAM Producibility Enhancement Program (APREP) changes into the missile.

The government will bear the costs of designing and qualifying changes directly attributable to the AMRAAM program. The prime

contractors and vendors will absorb costs of certain increases in technology within independent research and development (IR&D) and other contractor investment sources (e.g., profits and commercial sources) depending on the generic applicability of the technology to the company's overall business base.

Net savings consider the effect of design, qualification (prove-in), and delta investment cost of changed special tooling and test equipment (ST/STE) beyond the current production baseline. The government and contractors share the investment costs, depending on the appropriateness of investment category: special versus capital. The APREP proposals all indicated that special tooling and test equipment cost deltas (over and above what we had already planned for on the baseline program) were minimal. In some cases, there could be a cost reduction in ST/STE where the changed design requires less ST/STE than the baseline. We do not know the exact dollars associated with each project at this time. We have, however, requested detailed ST/STE plans from Hughes and Raytheon to include Full Scale Development (FSD) and Lot I ST/STE, so that we can gauge the impact on APREP and definitize the dollars prior to placing any of the projects on contact.

We do not agree with the Navy's approach to contractor investment. The Air Force believes that the shared approach to tooling/test equipment/manufacturing costs is equitable to all involved and is appropriate for the AMRAAM program.

## AMRAAM CONTRACTOR INSPECTION

Question: Are funds obligated after March 1, 1986 included in the $556.6 million cap?

Is it correct that some $411.6 thousand was deleted from the recordable obligation amount for contractor inspection and repair of three reliability test vehicles?

If so, will that work be performed?

If so, when and who bears the cost?

Answer: The $556.6 million cap on the Hughes development contract does not include any funds to be obligated after March 1, 1986. The Air Force has already obligated 3600 funds just short of the cap and plans to maintain this cap that the Secretary of Defense has certified to. The Air Force did deobligate approximately $411,600 from the contract for contractor inspection and repair (IRAN) of three missiles from the Captive Carry Reliability Program (CCRP). This work will not be accomplished. When the full scale development (FSD) program was restructured from 50 to 79 months, missile allocations were changed and rephased. As a result, it is now necessary to refurbish fewer missiles (seven versus ten) then originally planned.

## GAO ESTIMATED PRODUCTION COST OF AMRAAM

Question: GAO states that the Air Force's estimated production cost of $5.2 million in fiscal year 1984 dollars for 17,123 missiles is based on a number of assumptions and that "historically, similar assumptions, for the major acquisitions have changed over time."

What is the basis for your assumptions? For example, is it correct that you assume that no model or major design changes will be made to the missile over the next ten years?

Answer: The $5.2 billion (FY 1984 dollars) Air Force production cost estimate for 17,108 AMRAAMs is based on a number of assumptions that are conservative and meet the test of reasonableness. The GAO report focuses on assumptions basic to key AMRAAM program parameters; specifically, annual procurement quantities, funding profiles, and major design changes. In regard to quantities and funding, we recognize that other missile programs have changed significantly from their original production plans. The production cost cap imposed on AMRAAM makes this program unique and is the basis for our confidence in being able to perform in accordance with our procurement plan. The $5.2 billion cap is, in effect, a contract between the Congress and the Department of Defense (DoD) to maintain the necessary quantity/funding profiles. The Secretary of Defense (SECDEF) has certified to the cost cap ($7.0 billion for 24,335 USAF/USN missiles; $5.2 billion for 17,108 USAF missiles) which is his commitment to request the necessary AMRAAM funds in the DoD budget. We believe that the Congress, in passing the law requiring the cost cap, is also committed to meeting the Administration's budget requests necessary to stay within the cost cap. In regard to design changes, the AMRAAM producibility enhancement program has been factored into the estimate already. Major design or model changes have not been included in the estimate. To do so would be inappropriate in that no program should be held accountable to budget as a hedge against technological surprise.

## AMRAAM PROCUREMENT UNIT COST

Question: Is it correct that the total procurement unit cost for 17,123 missiles in fiscal year 1984 dollars is $304,000?

If so, how do you achieve this unit cost?

Answer: The Air Force procurement unit cost for 17,108 missiles is $304,000 in FY 1984 dollars. This is achieved by the application of the appropriate learning curves to the two contractors that take into account the production rates, competition, and the incorporation of the producibility enhancement projects.

## AMRAAM LEARNING CURVE

Question: What is the learning curve assumed for the AMRAAM missile? How does this AMRAAM learning curve compare to learning curves for other Air Force air-to-air tactical missile programs?

Answer: The AMRAAM uses a series of learning curves that are specifically applicable to each contractor, the phase of production, and individual subsystems. These are then calculated and combined to come up with a composite learning curve of 81.4 percent. This compares to a composite learning curve of 78.4 percent for the AIM-7F and 82.2 percent for the AIM-9L. (NOTE: All figures are based on total program quantities and are comprised of hardware and recurring factory costs.)

## AMRAAM FULL SCALE DEVELOPMENT

Question: Is it correct that 122 test missiles are to be built and delivered by Hughes during the full-scale development phase?

How many have been delivered and accepted to date? How many have been returned and why?

Answer: Of the 122 equivalent missiles required by the FSD contract, a total of 25 have been delivered for test purposes.

Eleven missiles were returned to Hughes for analysis/repair. Missile problems seen so far are typical of a new missile in development. The problems encountered include missile startup problems, problems due to manufacturing processes, and test station/missile interface problems. Each missile returned has been analyzed and corrective action taken. Four of the eleven missiles are in a Test, Analyze, and Fix (TAAF) program, which subjects the vehicles to environments which force reliability growth by quickly identifying defects in design, material, or workmanship. The TAAF program is operating satisfactorily and the missile is well within the expected performance for reliability growth. Our analysis of the situation is there is no trend which indicates a faulty basic design.

AMRAAM TEST DATA

Question: What is the nature of the test data that you currently have available?

Is this test data the basis for your certification as to the missile's performance?

When will the tests be completed?

What is the schedule for those flights?

How will they be conducted?

How many test flights have been conducted to date?

Answer: Tests conducted, to date, are in the following categories:

1. Environmental Tests:

a. Objective: To determine captive AMRAAM environment. To demonstrate carriage of AMRAAMs throughout aircraft operating envelopes.

b. Method: Test vehicles measured AMRAAM captive environment. Test aircraft were used to evaluate flutter, loads, and aircraft stability.

c. Results: AMRAAM design has been validated. Integration is 100 percent complete with the F-15 and F-16 and 75 percent complete on the F/A-18. The tests reflect no problems.

2. DT/IOT&E AMRAAM Flight Tests:

a. Objectives: To evaluate AMRAAM performance.

b. Method: AMRAAM Captive Equipment (ACE) and free firing vehicles (Separation/Control Test Vehicle (S/CTV) and AMRAAM Aeronautical Vehicle-Instrumented (AAVI)) are used to evaluate missile performance.

c. Results: There have been two S/CTVs and three AAVIs successfully launched. ACE captive flights are progressing very well. Stages 1 and 2 software builds have been completed and evaluation of Stage 3 software is on schedule.

3. Integration of AMRAAM on Aircraft:

a. Objective: To insure aircraft/AMRAAM compatibility. To certify separation envelopes/compatibility with other weapons.

b. Method: Special vehicles such as Initialization Test Vehicles/Jettison Test Vehicles (ITV/JTVs) are used to integrate AMRAAM with the aircraft weapon system. Separation envelopes will be determined by live firings (S/CTV and AAVIs). Compatibility with other weapons (AIM-7/9/54) will be demonstrated through live firings.

c. Results: Integration has been demonstrated on the F-15 and F-16. Integration has been initiated on the F/A-18. The AIM-9 missile has been successfully launched from the AMRAAM rail.

4. AMRAAM Reliability/Supportability:

a. Objective: To determine the missile failure rate. To evaluate support equipment and the support program.

b. Method: Four AMRAAMs will be environmentally stressed in vibration/thermal chambers using the TAAF facility. AMRAAMs will be captive-carried by F-16 and F-15 aircraft during the Captive Carry Reliability Program (CCRP). Supportability was evaluated with loading demonstrations on all aircraft.

c. Results: TAAF tests are being conducted at the Pacific Missile Test Center. CCRP is underway.

All the test data accumulated through Feb 86, including that just described along with simulations and analysis, were used as the basis for missile performance certification. In addition, an assessment of the design via the Critical Design Review, and closeout of actions from the review, attested to the design completeness. This, coupled with all ground and flight test activities, provided the certification database.

RESULTS OF AMRAAM TEST FLIGHTS

Question: How do the results of those test flights compare to performance specifications? What is the extent of the deficiencies?

How does the remaining test flight schedule relate to the production schedule?

What is the cumulative fiscal commitment in procurement both in terms of number of missiles and dollars before the test program is completed?

Answer: Flight tests to date agree well with postflight simulations and exhibited no serious deficiencies that require modifications to the performance specifications. The objectives of the tests, to date, as well as results of tests, are outlined below:

1. Separation/Control Test Vehicle (S/CTV-1) - Launched 7 Dec 84:

a. Primary Objectives: To demonstrate the airframe maneuver response in a high altitude, low dynamic pressure environment.

b. Results: The missile successfully performed a 20g pitch and yaw maneuver. The response matched predictions well.

c. Anomalies: Unpredicted roll oscillation during first combined pitch/yaw maneuver. Missile remained stable and quickly returned to trim after maneuver completion.

2. AMRAAM Aeronautical Vehicle-Instrumented (AAVI-1) - Launched 14 Mar 85:

a. Primary Objectives: To gather AMRAAM seeker performance data and to investigate missile guidance capability.

b. Results: All objectives were met. The missile flew within the lethal radius of the target.

c. Deficiencies: None.

3. AAVI-2 - Launched 7 Aug 85:

a. Primary Objectives: To demonstrate the inertial launch capability and medium pulse repetition frequency (MPRF) acquisition and track capability in a look-down clutter environment.

b. Results: All objectives were met. The missile flew within the lethal radius of the target.

c. Deficiencies: None.

4. AAVI-3 - Launched 17 Sep 85:

a. Primary Objectives: To demonstrate AMRAAM capability to receive and utilize data link information and to demonstrate MPRF acquisition and track in a high closing velocity, nose aspect encounter.

b. Results: All objectives were met. The missile impacted the target.

c. Deficiencies: None.

5. S/CTV-2 Launched 7 Mar 86:

a. Primary Objectives: To evaluate missile response to high-G combined command in a high dynamic pressure environment, to confirm zero-lift drag in the transonic regime and to evaluate missile response to maneuvers in a subsonic, low energy environment.

b. Results: All objectives were met with response matching predictions well.

c. Anomalies: Zero-lift drag appears to be slightly higher than predicted. The data is under analysis.

6. AAVI-6 - Launched 25 Mar 86:

a. Primary Objectives: To demonstrate the missile command/inertial launch mode off the F-15, to evaluate full frequency bandwidth performance, to demonstrate high altitude and long range intercept, to evaluate the data link during a target maneuver, and to evaluate the target detection device/fuze performance.

b. Results: Missile hit the QF-100 target drone.

c. Anomalies: None observed; analysis of data is underway.

The remaining flight test schedule relates to the production schedule quite well. The current plan for flight testing is to achieve various levels of performance knowledge on the missile in support of the production decision process. For Milestone IIIA (Lot I low rate initial production decision) (Apr 87), it is planned that about half of the firings will be achieved. For the full production rate decision (Lot III) in Apr 89, all firings will be accomplished.

The test program completion is planned for Apr 88. At this time, approximately 15 percent of the production program costs will have been committed. This includes monies for initial producibility program efforts, for second source qualification, for Lot I production of 260 missiles, and for Lot II advanced buy for 833 missiles. Cumulative commitment at the end of the test program is approximately $1,067 million (then year dollars).

## SECOND GENERATION GROUND PROXIMITY WARNING SYSTEM

Question: For the last two years both the Armed Services Committee and the Defense Appropriations reports have strongly recommended that the Air Force expend some of its modification funds to procure a second generation ground proximity warning system to prevent needless controlled flight into terrain accidents. Could you please tell this committee what steps have been taken by the Air Force to honor these requests?

Answer: The Air Force is presently waiting for the results of a risk assessment that will be accomplished by the Air Force Logistics Command Logistics Operations Center in conjunction with the Air Force Inspection and Safety Center. Results of this assessment are expected by 30 May 1986. The primary user of transport aircraft, the Military Airlift Command, has stated that

the priority for installing second generation or better ground proximity warning systems in their aircraft will, in all probability, remain low on their modification priority list, unless the risk assessment shows an unexpectedly higher risk of current operation.

The controlled flight into terrain rate for fighter/attack aircraft is roughly 12 times higher than the rate for transport aircraft. The FY 87 President's Budget includes funds to procure a ground collision avoidance system (GCAS) for A-10 aircraft. In addition, the Air Force is completing a feasibility study on a standard GCAS. The key feature of both the A-10 and standard GCAS is government furnished/developed software algorithms which when integrated with existing systems (such as radar altimeters) will produce the desired capability. Further, the Air Force believes that the standard GCAS algorithm is adaptable to transport aircraft and may provide a relatively inexpensive GCAS or GPWS capability for those aircraft.

## AIRCRAFT ACCIDENTS

Question: How many aircraft has the Air Force lost in the past 2 years from inadvertent flight-into-terrain? What would be the cost of replacing these aircraft?

Answer: The following reflects lost aircraft and costs for the years 1984-1985 due to inadvertent flight-into-terrain. The costs listed do not reflect replacement cost. DODI 6055.7 instructs that aircraft material loss costs shall be figured using initial acquisition cost plus cost of modifications. Additionally, the costs listed do not reflect mishap casualties.

| Transport-Type Aircraft | | Fighter/Attack Aircraft | |
|---|---|---|---|
| C-130 | 2/$ 8,522,474 | A-7D | 2/$ 6,190,138 |
| RC-135 | 1/$ 6,821,453 | A-10A | 4/$ 24,105,248 |
| | 3/$ 15,343,927 | OA-37 | 1/$ 518,963 |
| **Bomber Aircraft** | | F-4 | 5/$ 10,478,190 |
| B-52 | 1/$ 15,728,574 | F-15 | 2/$ 22,521,864 |
| **Helicopters** | | F-16 | 8/$ 66,542,656 |
| HH-3 | 1/$ 558,886 | F-111 | 1/$ 13,826,156 |
| CH-3 | 1/$ 916,316 | | 23/$144,183,215 |
| | 2/$ 1,475,202 | Totals | 29/$176,734,918 |

## GROUND PROXIMITY WARNING SYSTEM UPGRADE

Question: Since 1974, when Congress mandated that all commercial carriers carrying more than 30 passengers were required to have a ground proximity warning system, the number of accidents resulting from controlled flight into the terrain has decreased dramatically. Because of this most airlines have seen fit to upgrade the originally installed systems with a second generation system. I note that there are 430 Air Force aircraft equipped with a first generation system. Could you tell the committee why in the face of numerous accidents the Air Force has not felt compelled to provide their aircrews with the best possible system available?

Answer: During the past five years, the controlled flight into terrain (CFIT) rate for transport aircraft has been 0.07 accidents per 100,000 flying hours. While many transport aircraft have the first generation ground proximity warning system (GPWS) installed, second generation systems are either on or planned for (as part of the aircraft procurement package) the following aircraft: C-5B, C-20, E-4, KC-10, RC-135 and C-17.

F/A-18 HORNET

THE F/A-18 STRIKE FIGHTER CONTINUES TO DISPLAY HIGH PERFORMANCE AND RELIABILITY AS IT IS EMPLOYED IN INCREASING NUMBERS IN BOTH NAVAL AND MARINE SQUADRONS. FULLY COMBAT-CAPABLE, DUAL-COCKPIT AIRCRAFT ARE USED AS TRAINING SQUADRON AIRCRAFT. BEGINNING IN 1990, THE DUAL-COCKPIT AIRCRAFT WILL BE USED IN THE MARINE TACTICAL AIR CONTROL (AIRBORNE) MISSION AND AS MARINE RECONNAISSANCE AIRCRAFT. THE F/A-18 STRIKE FIGHTER IS A TRUE FORCE MULTIPLIER THAT PROVIDES THE OPERATIONAL COMMANDER WITH A SYNERGISTIC EFFECT WHEN USING THIS REMARKABLE AIRCRAFT IN EITHER THE FIGHTER OR ATTACK ROLE. THE F/A-18 IS THE NATION'S FIRST STRIKE-FIGHTER, DESIGNED FOR SUCH TRADITIONAL STRIKE (ATTACK) APPLICATIONS AS INTERDICTION AND CLOSE AIR SUPPORT WITHOUT COMPROMISING FIGHTER (ESCORT AND FLEET AIR DEFENSE) CAPABILITIES. THE RESULT IS A STRIKE AIRCRAFT WITH EXCELLENT FIGHTER AND SELF-DEFENSE CAPABILITIES THAT INCREASES STRIKE MISSION SURVIVABILITY AND SUPPLEMENTS THE F-14 IN OUTER AIR BATTLE.

THE HORNET RECEIVES ITS FIRST MAJOR BLOCK UPDATE UNDER A FIRM FIXED PRICE CONTRACT BEGINNING WITH THE FY-86 PROCUREMENT. THIS UPGRADE EQUIPS THE F/A-18 WITH PROVISIONS FOR ADVANCED MEDIUM RANGE AIR-TO-AIR MISSILE (AMRAAM), ADVANCED SELF-PROTECTION JAMMER (ASPJ), IMAGING INFRARED ($I^2R$) MAVERICK (AGM-65F), AND AN AIRCRAFT MAINTENANCE MONITORING SYSTEM. AS THIS IS A SIGNIFICANT CHANGE IN AIRCRAFT OPERATIONAL CAPABILITY AND LOGISTICAL SUPPORT, WE HAVE REDESIGNATED THOSE FY-86 AND SUBSEQUENT AIRCRAFT AS F/A-18C, FOR SINGLE-SEAT AIRCRAFT, AND F/A-18D FOR TWO-SEAT AIRCRAFT. THE NIGHT ATTACK/AUSTERE ALL-WEATHER DEVELOPMENT CONTINUES THIS YEAR UNDER A JOINT AV-8B/F/A-18 FIXED-PRICE DEVELOPMENT CONTRACT. THE ADDITION OF A FIXED FIELD-OF-VIEW NAVIGATIONAL FLIR, TOGETHER WITH NIGHT-VISION-GOGGLES, AND A COLOR DIGITAL MAP DISPLAY, WILL OPEN THE NIGHT AND UNDER-THE-WEATHER REGIME TO VISUAL NAVIGATION AND TARGET ATTACK WITH VIRTUALLY THE SAME ACCURACY AS DURING DAYLIGHT HOURS. THE TWO-SEAT F/A-18D, IN ADDITION TO THESE ENHANCEMENTS, WILL BE EQUIPPED WITH DECOUPLED REAR COCKPITS. THIS WILL ALLOW THE AIRCREW IN THE

REAR COCKPIT TO INDEPENDENTLY OPERATE SENSORS AND DISPLAYS.

BEGINNING IN FY-90, A LIMITED NUMBER OF U.S. MARINE CORPS F/A-18D'S WILL BE EQUIPPED WITH A RECONNAISSANCE SENSOR PALLET WHICH WILL REPLACE THE 20MM GUN IN THOSE AIRCRAFT SO EQUIPPED. THESE RECONNAISSANCE-CAPABLE AIRCRAFT WILL BE FOLDED INTO THE MARINE CORPS FIGHTER/ATTACK SQUADRONS.

FOURTEEN NAVY AND MARINE CORPS HORNET SQUADRONS ARE OPERATING TODAY FROM 19 BASES AND TWO AIRCRAFT CARRIERS. TOTAL FLIGHT HOURS EXCEED 200,000.

ONE YEAR AFTER INITIAL OPERATIONAL CAPABILITY OF OUR FIRST STRIKE-FIGHTER SQUADRON, USS CONSTELLATION DEPLOYED TO THE WESTERN PACIFIC WITH TWO HORNET SQUADRONS ABOARD. DURING THIS INITIAL DEPLOYMENT, THE F/A-18 DEMONSTRATED THE VERY HIGH MISSION RELIABILITY AND EFFECTIVENESS PROJECTED FOR THE HORNET. OUR SECOND HORNET-EQUIPPED AIRCRAFT CARRIER, USS CORAL SEA, WITH FOUR STRIKE-FIGHTER SQUADRONS EMBARKED, IS NOW ON STATION IN THE MEDITERRANEAN. THESE SQUADRONS CONTINUE TO ENJOY HIGH AVAILABILITY RATES AND UNPRECEDENTED READINESS RATES.

THE DEPARTMENT OF THE NAVY F/A-18 INVENTORY AS OF JANUARY 1986 IS 278 WITH AN ADDITIONAL 204 AIRCRAFT FUNDED AND UNDELIVERED. THE PROCUREMENT COST THROUGH THE BUDGET YEAR IS $19,697 MILLION. FY-87 REQUEST INCLUDES $3,406.7 MILLION FOR THE PRODUCTION OF 120 AIRCRAFT AND ADVANCE PROCUREMENT OF 132 AIRCRAFT IN FY-88 IN ORDER TO TAKE ADVANTAGE OF A MORE EFFICIENT PRODUCTION RATE AND FURTHER REDUCE THE F/A-18 ACQUISITION COST. THIS REPRESENTS AN INCREASE OF 36 AIRCRAFT OVER LAST YEAR'S REQUEST. THE RECURRING FLYAWAY COST OF THE F/A-18 IS $18.7 MILLION.

## F-14A TOMCAT

THE F-14A IS OUR HIGH PERFORMANCE, MARITIME AIR SUPERIORITY FIGHTER. IT IS A TWO-PLACE, VARIABLE SWEEP WING, SUPERSONIC, CARRIER-BASED AIRBORNE WEAPONS SYSTEM. THE F-14 HAS AN ALL-WEATHER CAPABILITY TO DELIVER PHOENIX AND SPARROW MISSILES USING THE AWG-9 WEAPONS CONTROL SYSTEM WITH THE SIDEWINDER MISSILES AND THE M-61 GUN

FOR CLOSE-IN AIR-TO-AIR COMBAT. THE F-14 IS POWERED BY TWIN TF30-P-414A ENGINES. COMMENCING IN FY-86, THE F-14A(PLUS) WILL HAVE A NEW ENGINE, THE GENERAL ELECTRIC F-110, WHICH WILL PROVIDE MAJOR IMPROVEMENTS IN BOTH SAFETY AND PERFORMANCE. A MAJOR UPGRADE OF THE F-14 AIRCRAFT IS PLANNED FOR PRODUCTION INCORPORATION IN FY-88 WHICH WILL ENHANCE THE OPERATIONAL CAPABILITY WITH IMPROVEMENTS IN ELECTRONIC COUNTER-COUNTER MEASURES IN THE RADAR, A DIGITAL AVIONICS SUITE, AND THE IMPROVED ENGINE PERFORMANCE AND RELIABILITY OF THE F-110.

THE F-14A INVENTORY AS OF JANUARY 1986 IS 449 WITH 51 AIRCRAFT FUNDED AND UNDELIVERED. THE PROCUREMENT COST THROUGH THE BUDGET YEAR IS $13,807.4 MILLION. THE FY-87 REQUEST INCLUDES $695.9 MILLION FOR THE PRODUCTION OF 15 AIRCRAFT AND ADVANCE PROCUREMENT FOR 12 AIRCRAFT IN FY-88 (5 F-14A(PLUS) AND 7 F-14D). THE RECURRING FLYAWAY COST OF THE F-14A(PLUS) IS $36.2 MILLION FY-86).

## E-2C HAWKEYE

THE E-2C IS AN ALL WEATHER, CARRIER-BASED, AIRBORNE EARLY WARNING (AEW) AIRCRAFT. IT CARRIES A CREW OF FIVE: PILOT, CO-PILOT, COMBAT INFORMATION CENTER OFFICER, AIR CONTROL OFFICER AND FLIGHT TECHNICIAN. THE E-2C HAS A HIGH WING, A 24 FOOT ROTODOME, MOUNTED ABOVE THE FUSELAGE AND WILL BE POWERED (BY THE END OF FY-86 PRODUCTION) WITH TWO T56-A-427 TURBO-PROP ENGINES.

THE E-2C EXTENDS TASK FORCE DEFENSE PERIMETERS BY PROVIDING EARLY WARNING OF APPROACHING ENEMY UNITS AND BY VECTORING INTERCEPTORS INTO ATTACK POSITION. IN ADDITION TO THIS FUNCTION, THE HAWKEYE ALSO PROVIDES STRIKE CONTROL, AIR TRAFFIC CONTROL, RADAR SURVEILLANCE, SEARCH AND RESCUE ASSISTANCE, COMMUNICATIONS RELAY, AND AUTOMATIC TACTICAL DATA EXCHANGE.

FY-86 BEGINS THE MAJOR UPDATE OF THE E-2C'S ELECTRONICS SUITE. THIS UPDATE WILL ENSURE THE E-2C's AEW ADVANTAGE AGAINST THE THREAT THROUGH THE 1990'S. THE INCREASE IN AIRCRAFT WEIGHT DUE TO THESE IMPROVEMENTS AND OTHER STRUCTURAL MODIFICATIONS HAS BROUGHT ABOUT

THE URGENT REQUIREMENT FOR THE UPGRADED T56-A-427 ENGINE.

THE E-2C INVENTORY AS OF JANUARY 1986 IS 83 WITH 13 AIRCRAFT FUNDED AND UNDELIVERED. THE PROCUREMENT COST THROUGH THE BUDGET YEAR IS $3,849.8 MILLION. THE FISCAL YEAR 1987 REQUEST INCLUDES $335.3 MILLION FOR THE PRODUCTION OF 6 AIRCRAFT AND ADVANCE PROCUREMENT FOR 6 AIRCRAFT IN FY-88. THE RECURRING FLYAWAY COST OF THE E-2C IS $40.3 MILLION.

## S-3A VIKING

THE S-3A VIKING IS AN EXTREMELY VERSATILE MULTI-MISSION CARRIER-BASED AIRCRAFT WITH A PRIMARY MISSION OF ANTISUBMARINE WARFARE. ITS SPEED, RANGE, DETECTION CAPABILITIES AND RELIABILITY MAKE IT HIGHLY EFFECTIVE COMPONENT OF THE CARRIER BATTLE GROUP'S ASW FORCE. IN SUCH MISSIONS AS MINING, COMMAND AND CONTROL, THREAT WARNING, AND SURFACE SURVEILLANCE/IDENTIFICATION/CLASSIFICATION, IT IS OFTEN THE OPERATIONAL COMMANDER'S FIRST CHOICE.

ALTHOUGH THE S-3A IS NO LONGER IN PRODUCTION, A WEAPON SYSTEM IMPROVEMENT PROGRAM, OR WSIP, WILL RETROFIT AVIONICS AND WEAPONS SUBSYSTEMS TO COUNTER THE SUBMARINE THREAT OF THE 1990'S. THE RESULTANT S-3B WILL INCORPORATE STATE-OF-THE-ART TECHNOLOGY FOR INCREASED RADAR DETECTION RANGE AND CLASSIFICATION, ADVANCED ACOUSTIC PROCESSING, INCREASED ELECTRONIC SUPPORT MEASURES CAPABILITY, AND INTEGRATION WITH THE HARPOON MISSILE. CURRENT PLANS CALL FOR CONVERSION OF 160 S-3A'S TO S-3B'S. THE FY-87 BUDGET REQUESTS $215.4 MILLION IN AIRCRAFT MODIFICATION FUNDS TO CONTINUE THE PROGRAM.

## P-3C ORION

THE P-3C IS OUR SHORE-BASED, LONG RANGE ANTISUBMARINE WARFARE AND MARITIME SURVEILLANCE AIRCRAFT AND HAS BEEN IN PRODUCTION SINCE 1969. THE P-3C HAS ENJOYED AN EVOLUTIONARY DEVELOPMENT OF ITS SENSOR SYSTEMS THROUGH A SERIES OF UPDATE PROGRAMS. THE LATEST IMPROVEMENT IS UPDATE III WHICH ADDS THE PROTEUS ADVANCED SIGNAL PROCESSOR, SIGNIFICANTLY IMPROVING THE ORION'S ABILITY TO DETECT,

TRACK, AND ATTACK QUIETER, NEW GENERATION SOVIET SUBS. THE FIRST UPDATE III P-3C AIRCRAFT ENTERED FLEET SERVICE IN MAY OF 1984. WE HAVE UNDER DEVELOPMENT THE NEXT MAJOR UPDATE TO THE P3C, UPDATE IV, WHICH WILL FURTHER INCREASE OUR CAPABILITY TO COUNTER THE RAPID QUIETING TREND OBSERVED IN SOVIET SUBMARINES. THIS MODIFICATION IS SCHEDULED TO ENTER THE FLEET IN THE 1990'S. WE HAVE 24 ACTIVE P-3 SQUADRONS, 21 OF WHICH OPERATE THE P3C AND THREE OF WHICH FLY THE P-3B. THERE ARE ALSO 13 RESERVE SQUADRONS WHICH FLY P-3A'S AND P-3B'S.

THE P-3C INVENTORY AS OF JANUARY 1986 IS 234 WITH 18 AIRCRAFT FUNDED AND UNDELIVERED. THE PROCUREMENT COST THROUGH THE BUDGET YEAR IS $5,807.0 MILLION. THE FY-87 REQUEST INCLUDES $431.8 MILLION FOR THE PRODUCTION OF NINE AIRCRAFT AND $98.4 MILLION ADVANCE PROCUREMENT FOR PRODUCTION OF NINE AIRCRAFT IN FY-88. THE RECURRING FLYAWAY COST OF THE P-3C IS $34.7 MILLION.

## LAMPS MK I & II

TWO TYPES OF LIGHT AIRBORNE MULTI-PURPOSE SYSTEM HELICOPTERS ARE EMPLOYED ON OUR SURFACE SHIPS TO MAXIMIZE THEIR ANTISUBMARINE WARFARE CAPABILITY. FOR THOSE COMBATANTS WHICH CANNOT ACCOMMODATE THE NEW SH-60B (LAMPS MK III), WE MUST CONTINUE TO PROVIDE THE SH-2F (LAMPS MK I). THIS SYSTEM IS PROJECTED TO REMAIN THE PRIMARY ASW SENSOR FOR OVER 80 SURFACE COMBATANTS THROUGH THE YEAR 2000 AND BEYOND, THEREFORE, WE MUST SIGNIFICANTLY UPGRADE THE LAMPS MK I SH-2F AIRCRAFT TO MAINTAIN ITS WARFIGHTING CAPABILITY.

THE SPECIFIC UPGRADES INCLUDE T-700 ENGINES, ONBOARD SONOBUOY PROCESSING CAPABILITY, 99 CHANNEL SONOBUOY CAPABILITY AND SECURE TACNAV (TACTICAL NAVIGATION) DATA LINK. A REPORT WHICH DETAILS OUR STUDY AND CONCLUSIONS ON THIS SUBJECT IS BEING PROVIDED TO THE SENATE AND HOUSE APPROPRIATIONS COMMITTEES. IN ADDITION, WE ARE REVIEWING A MULTI-MISSION MODULAR ($M^3C$) CONCEPT OF UPGRADING THE SH-2F WHICH CAN MAXIMIZE THE CAPABILITIES OF THE SH-2F. MODULAR UPGRADES IN KIT FORM ARE UNDER INVESTIGATION TO MEET MK I SHIP TASKINGS IN ASW, ASUW, COMBAT SAR AND SURVEILLANCE.

THE SH-60B SEAHAWK IS THE AIR SUBSYSTEM OF THE LAMPS MK III SYSTEM SCHEDULED FOR FFG-7, DD-963, DDG-993, AND CG-47 CLASS SHIPS. THE TOTAL MK III SYSTEM INCLUDES THE SH-60B, THE SHIP'S ELECTRONICS, A HELICOPTER LANDING SYSTEM, AND HELICOPTER SUPPORT FACILITIES. LAMPS MK III IS A COMPUTER-INTEGRATED, SHIP/HELICOPTER COMBAT SYSTEM THAT GREATLY INCREASES THE FLEXIBILITY, COMBAT RANGE AND EFFECTIVENESS OF SURFACE COMBATANTS. THE SH-60B PASSES SONOBUOY INFORMATION THROUGH AN ADVANCED SECURE DATA-LINK TO THE LAMPS MK III SHIP FOR PROCESSING. IN ADDITION, THE SH-60B HAS FULL ONBOARD PROCESSING CAPABILITY. ELECTRONIC SUPPORT MEASURES (ESM) DATA, RADAR DATA, AND VOICE COMMUNICATIONS CAN ALSO BE PASSED ON THE DATA LINK. 1985 MARKED THE FIRST YEAR IN WHICH THE LAMPS MK III SYSTEM WAS FULLY DEPLOYED ON FOUR FFG'S. ALL DEPLOYMENTS DEMONSTRATED HIGH PERFORMANCE AND CONFIRMED THE FORCE MULTIPLIER PROJECTIONS MADE FOR THE MK III SYSTEM.

BOTH LAMPS MK I AND MK III SYSTEMS USE HOMING TORPEDOES FOR SUBMARINE ATTACK. ADDITIONALLY, THE PENGUIN ANTI-SHIP MISSILE IS BEING PROCURED FOR THE SH-60B. THE COMBINED LAMPS WEAPON SYSTEMS ARE ESSENTIAL ELEMENTS OF OUR BATTLE GROUPS, SURFACE ACTION GROUPS AND IN TIME OF WAR WOULD PLAY A CRITICAL ROLE IN CONVOY ESCORT.

THE SH-2F INVENTORY AS OF JANUARY 1986 IS 103 WITH 22 AIRCRAFT FUNDED AND UNDELIVERED. THE PROCUREMENT COST THROUGH THE BUDGET YEAR IS $582.0 MILLION. THE FISCAL YEAR 1987 REQUEST INCLUDES $52.8 MILLION FOR THE PRODUCTION OF SIX AIRCRAFT. THE RECURRING FLYAWAY COST OF THE SH-2F IS $8.6 MILLION.

THE SH-60B INVENTORY AS OF JANUARY 1986 IS 50 WITH 58 AIRCRAFT FUNDED AND UNDELIVERED. THE PROCUREMENT COST THROUGH THE BUDGET YEAR IS $3220.6 MILLION. THE FISCAL YEAR 1987 REQUEST INCLUDES $220.8 MILLION FOR PRODUCTION OF 17 AIRCRAFT AND ADVANCE PROCUREMENT FOR SIX AIRCRAFT IN FISCAL YEAR 1988. THE RECURRING FLYAWAY COST OF THE SH-60B IS $12.2 MILLION.

## SH-60F

THE SH-60F IS UNDER DEVELOPMENT TO REPLACE THE SH-3H AS OUR

CARRIER INNER-ZONE ASW HELICOPTER. A FIRM-FIXED PRICE CONTRACT HAS BEEN SIGNED WITH SIKORSKY FOR DEVELOPMENT OF THE SH-60F--THIS CONTRACT INCLUDES FIRM-FIXED PRICE OPTIONS FOR THE FIRST FIVE LOTS OF PRODUCTION. TWO TEST AND EVALUATION AIRCRAFT ARE BEING BUILT AND WILL FLY IN JANUARY 1987. THE SH-60F WILL EMPLOY THE NEW AQS-13F ACTIVE DIPPING SONAR IN ADDITION TO SONOBOUYS TO TRACK AND ATTACK SUBMARINES. IT WILL USE ASW HOMING TORPEDOES AS ITS PRIMARY WEAPON. THE FY-87 REQUEST INCLUDES $168.1 MILLION FOR PROCUREMENT OF SEVEN SH-60F AIRCRAFT AND ADVANCE PROCUREMENT FOR 18 SH-60F FOR FY-88.

## AV-8B HARRIER

THE AV-8B, AN IMPROVED VECTORED THRUST V/STOL AIRCRAFT, BASED UPON THE AV-8A CONCEPT AND UTILIZING THE PEGASUS II ENGINE, HAS UP TO TWICE THE RANGE OR PAYLOAD OF THE OLDER HARRIER. IT COMBINES AERODYNAMIC IMPROVEMENTS WITH AN ANGLE RATE BOMBING SYSTEM FOR INCREASED WEAPONS DELIVERY ACCURACY, AND IT HAS A NEW STABILITY AUGMENTATION SYSTEM TO REDUCE PILOT WORKLOAD. THE RESULT IS A MUCH MORE CAPABLE AND RELIABLE AIRCRAFT. THE AV-8B WILL MEET THE MARINE CORPS REQUIREMENT FOR A LIGHT ATTACK AIRCRAFT TO PROVIDE RESPONSIVE OFFENSIVE AIR POWER THAT CAN OPERATE FROM AUSTERE FORWARD SITES IN DIRECT SUPPORT OF GROUND FORCES.

THE AV-8B INVENTORY AS OF JANUARY 1986 IS 43 WITH 81 FUNDED AND UNDELIVERED. THE PROCUREMENT COST THROUGH THE BUDGET YEAR IS $3,480.8 MILLION. THE FY-87 REQUEST INCLUDES $700.3 MILLION FOR THE PRODUCTION OF 42 AIRCRAFT AND ADVANCE PROCUREMENT FOR 42 AIRCRAFT IN FY-88. THE RECURRING FLYAWAY COST OF THE AV-8B IS $16.6 MILLION.

THE AV-8B HAS BEEN A RESOUNDING SUCCESS, BOTH TECHNICALLY AND ECONOMICALLY. IN 1983, THE CONTRACT WAS CHANGED FROM A COST-PLUS-INCENTIVE TO A FIRM-FIXED PRICE. AT MILESTONE IIIA, IT WAS STIPULATED THAT THE PROGRAM BE UNDER A $22 MILLION FLYAWAY COST IN 1984. IT AVERAGED $18.1 MILLION THAT YEAR, 20 PERCENT BELOW EXPECTATIONS. BY 1985, THE FLYAWAY WAS DOWN TO $16.6 MILLION AND IS EXPECTED TO AVERAGE $15.4 MILLION IN 1986.

A-6E INTRUDER

THE A-6E IS THE NAVY'S ONLY TRUE ALL-WEATHER, LOW-LEVEL, DEEP STRIKE/INTERDICTION ATTACK AIRCRAFT. IT INCORPORATES A SOLID STATE WEAPONS RELEASE SYSTEM, A SINGLE INTEGRATED TRACK AND SEARCH RADAR WITH A MOVING TARGET INDICATING SYSTEM, AND AN INERTIAL NAVIGATION SYSTEM.

AN ADDED CAPABILITY, TARGET RECOGNITION ATTACK MULTISENSOR (TRAM), HAS BEEN PROCURED SINCE 1976. THIS MAJOR SUBSYSTEM, PROCURED UNDER A MULTIYEAR PRODUCTION CONTRACT, INCLUDES AN INFRARED SENSOR, A LASER RANGER/DESIGNATOR AND A LASER RECEIVER. TRAM GIVES THE INTRUDER THE CAPABILITY TO DELIVER LASER GUIDED WEAPONS AND MARKEDLY IMPROVES ITS NIGHT SURVEILLANCE AND IDENTIFICATION CAPABILITY.

AS REPORTED LAST YEAR, WE DISCOVERED WING FATIGUE CRACKING IN SOME OF OUR A-6E AND KA-6D AIRCRAFT, CAUSING US TO REDUCE OUR SERVICE LIFE EXPECTATIONS BASED UPON CURRENT FLEET USAGE PROJECTIONS.

TO CORRECT THIS PROBLEM, WE HAVE COMPETED A "NEW" WING AS A FORM, FIT AND FUNCTION REPLACEMENT FOR THE PRESENT A-6 WING, AND A CONTRACT FOR A WING WITH AN 8,800-HOUR SERVICE LIFE HAS BEEN AWARDED TO BOEING MILITARY AIRPLANE COMPANY. THIS COMPOSITE STRUCTURE WING WILL HAVE MORE THAN TWICE THE SERVICE LIFE OF THE PRESENT DESIGN. DELIVERIES ARE SCHEDULED TO COMMENCE IN EARLY FY-88. THE WING WILL BE PROVIDED AS GOVERNMENT FURNISHED EQUIPMENT (GFE) FOR INSTALLATION ON FY-87 A-6E PRODUCTION AIRCRAFT AND ON NEW PROCUREMENT A-6F AIRCRAFT. IT WILL BE RETROFITTED, AS WELL, ON EXISTING A-6 AIRCRAFT TO EXTEND THEIR SERVICE LIVES AND CORRECT FATIGUE DISCREPANCIES, COMMENCING IN FY-88.

THE A-6E INVENTORY AS OF JANUARY 1986 IS 343 WITH 23 AIRCRAFT FUNDED AND UNDELIVERED. THE PROCUREMENT COST THROUGH THE BUDGET YEAR IS $3,500.0 MILLION. THE FY-87 REQUEST INCLUDES $390.1 MILLION FOR THE PRODUCTION OF ELEVEN AIRCRAFT, AND ADVANCE PROCUREMENT FOR 12 A-6F AIRCRAFT IN FY-88. THE RECURRING FLYAWAY COST OF THE A-6E IS $23.3 MILLION.

A SIGNIFICANTLY IMPROVED MODEL OF THE INTRUDER, THE A-6F, IS NOW UNDER DEVELOPMENT WITH A FIXED PRICE RESEARCH AND DEVELOPMENT CONTRACT, AND NOT-TO-EXCEED PRICES NEGOTIATED FOR THE FIRST THREE PRODUCTION YEARS. PROCUREMENT WILL BEGIN IN FY-88. THE A-6F REPRESENTS A MAJOR ADVANCEMENT IN ALL-WEATHER-ATTACK TECHNOLOGY. IT WILL INCORPORATE A NEW ENGINE AND DIGITAL AVIONICS WHICH WILL FURTHER IMPROVE RELIABILITY, MAINTAINABILITY AND PERFORMANCE. SURVIVABILITY WILL BE ENHANCED THROUGH INCORPORATION OF THE LATEST ADVANCES IN FIRE AND EXPLOSION SUPPRESSION AND IMPROVED STANDOFF TARGETING. HIGH RESOLUTION RADAR AND AN AIR-TO-AIR CAPABILITY PROVIDE MAJOR IMPROVEMENTS IN WEAPONS SYSTEM PERFORMANCE.

## EA-6B PROWLER

THE EA-6B IS A FOUR-PLACE, TWIN ENGINE DERIVATIVE OF THE A-6 ATTACK AIRCRAFT. THE AIRCRAFT IS A FULLY INTEGRATED ELECTRONIC WARFARE WEAPON SYSTEM THAT COMBINES LONG-RANGE, ALL-WEATHER CAPABILITY WITH ADVANCED ELECTRONIC COUNTERMEASURES AND ELECTRONIC SUPPORT MEASURES SYSTEMS. IT CAN CARRY UP TO FIVE JAMMER PODS WHICH HOUSE THE HIGH POWER JAMMING TRANSMITTERS CAPABLE OF OPERATING AGAINST VARIOUS THREAT EMITTERS. THE EA-6B, WITH AN IN-FLIGHT REFUELING CAPABILITY, IS DESIGNED FOR CARRIER AND/OR ADVANCED BASE OPERATIONS AND IS INTEGRAL TO THE MARITIME STRATEGY.

THE PRIMARY MISSION OF THE EA-6B IS TO SUPPORT STRIKE AIRCRAFT, AMPHIBIOUS OPERATIONS AND PROVIDE A COUNTER-TARGETING CAPABILITY FOR BATTLE GROUPS BY SUPPRESSING AND DEGRADING AN ENEMY'S ELECTRONIC SYSTEMS THROUGH TACTICAL JAMMING. SECONDARY MISSIONS INCLUDE PASSIVE EARLY WARNING FOR FLEET DEFENSE AND OBTAINING TACTICAL ELECTRONIC INTELLIGENCE WITHIN A COMBAT AREA. THE EA-6B IS THE ONLY CARRIER BASED AIRCRAFT WHICH PROVIDES THESE CAPABILITIES.

PRESENTLY, THERE IS A SHORTAGE OF THE EA-6B AIRCRAFT TO MEET NAVY AND MARINE CORPS FORCE LEVEL REQUIREMENTS. IN ORDER TO ALLEVIATE THIS SITUATION, WE HAVE RECENTLY INCREASED THE PROCUREMENT OF EA-6B'S TO 12 PER YEAR STARTING WITH FY-86 AND CONTINUING THROUGH THE FYDP. THIS PROCUREMENT SCHEDULE WILL ALLOW THE NAVY TO INCREASE

THE NUMBER OF NAVY EA-6B SQUADRONS DURING THE NEXT FEW YEARS TO SUPPORT THE ADDITIONAL AIR WINGS, FULFILL THE MARINE CORPS EA-6B REQUIREMENTS, AND MODERNIZE OUR RESERVE VAQ SQUADRONS.

THE EA-6B INVENTORY AS OF JANUARY 1986 IS 81, WITH 23 AIRCRAFT FUNDED AND UNDELIVERED. THE PROCUREMENT COST THROUGH THE BUDGET YEAR IS $4451.0 MILLION. THE FY-87 REQUEST INCLUDES $450.2 MILLION FOR THE PRODUCTION OF 12 AIRCRAFT AND ADVANCE PROCUREMENT FOR 12 AIRCRAFT IN FY-88. THE RECURRING FLYAWAY COST OF THE EA-6B IS $23.8 MILLION.

## T-45TS

AN IMPORTANT INGREDIENT IN THE MODERNIZATION OF OUR TACTICAL FORCES IS THE MODERNIZATION OF THE AIRCRAFT WITH WHICH WE TRAIN THE TACTICAL AVIATORS OF THE FUTURE. THE T-45TS IS A SYSTEMS APPROACH TO MEET THAT CRITICAL NEED. AN INTEGRATED SYSTEM CONSISTING OF AIRCRAFT, SIMULATORS AND ACADEMICS IS BEING BUILT AROUND THE FOLLOWING REQUIREMENTS: THE EARLIEST POSSIBLE INITIAL OPERATING CAPABILITY TO REDUCE THE IMPACT OF SHORTFALLS IN TRAINING AIRCRAFT INVENTORIES; THE ADVANTAGE OF DERIVATIVE TECHNOLOGY WHICH ENABLES A FIRM-FIXED PRICE R&D EFFORT; A PROCUREMENT SCHEDULE WHICH IS EXECUTABLE; AND AN APN FUNDING PROFILE WHICH IS AFFORDABLE. THE FULL SCALE ENGINEERING DEVELOPMENT PHASE IS WELL UNDERWAY WITH A FIRM-FIXED PRICE CONTRACT WHICH INCLUDES NOT TO EXCEED PRICES FOR THE FIRST THREE PRODUCTION OPTIONS.

FOR FY-87, ADVANCED PROCUREMENT FUNDS ARE REQUESTED IN THE AMOUNT OF $56.3 MILLION, WITH R&D FUNDS IN THE AMOUNT OF $134.2 MILLION.

## V-22A OSPREY

THE V-22A OSPREY (ORIGINALLY DESIGNATED THE JVX) PROGRAM HAS SUCCESSFULLY COMPLETED ITS PRELIMINARY DESIGN EFFORT AND IS READY FOR THE FULL SCALE DEVELOPMENT. FOLLOWING A GO-AHEAD DECISION IN MARCH 1986, THE PROGRAM WILL ENTER FULL SCALE DEVELOPMENT UNDER FIXED-PRICE CONTRACTS FOR BOTH THE AIRFRAME AND ENGINE. FIRST FLIGHT IS SCHEDULED FOR JUNE 1988. THE NAVY, MARINE CORPS AND AIR

FORCE ARE ACTIVE PARTICIPANTS IN THE DEVELOPMENT PHASE, WITH THE ARMY JOINING IN THE PROCUREMENT PHASE FOR A TOTAL PROGRAM ACQUISITION OF 913 AIRCRAFT. THE V-22A INCORPORATES A NEW AVIATION CONCEPT COMBINING THE BEST FEATURES OF A HELICOPTER WITH THOSE OF A FIXED WING TURBOPROP AIRCRAFT.

THE V-22 WILL LIKELY REVOLUTIONIZE THE AIRCRAFT INDUSTRY MUCH IN THE SAME MANNER AS THE HELICOPTER DID IN THE 1950'S. WHILE THE INITIAL EMPHASIS FOR THE V-22 HAS FOCUSED ON THE U.S. MARINE CORPS' REQUIREMENT TO RAPIDLY AND EFFECTIVELY MOVE TROOPS ASHORE DURING AMPHIBIOUS OPERATIONS, A HOST OF OTHER APPLICATIONS ARE BEING PLANNED FOR THIS REMARKABLE AIRCRAFT. IN ADDITION TO THE NAVY'S PLAN TO BUY 50 COMBAT SEARCH AND RESCUE AIRCRAFT, WE ARE EXAMINING SEVERAL VARIANTS WITH EXCITING POTENTIAL. THE LARGEST REQUIREMENT IS FOR 300 ASW AIRCRAFT AS THE REPLACEMENT FOR THE S-3A VIKING IN THE CARRIER-BASED FIXED-WING ANTISUBMARINE WARFARE ROLE. ADDITIONALLY, WE ARE STUDYING APPLICATIONS FOR THE OSPREY IN THE VERTICAL REPLENISHMENT, CARRIER ONBOARD DELIVERY (COD), ORGANIC MARITIME SURVEILLANCE, AND OVER THE HORIZON TARGETING MISSIONS. TECHNOLOGICAL SPINOFFS ARE ANOTHER FERTILE AREA THAT CAN BE EXPLORED AS THIS ADVANCED TECHNOLOGY IS EXPLORED FULLY. WE EXPECT THAT THE OTHER SERVICES AND CIVIL AVIATION WILL ORDER MORE OSPREY'S ONCE IT IS IN FULL-SCALE DEVELOPMENT AND HAS DEMONSTRATED ITS ENORMOUS POTENTIAL. ADDITIONAL VARIANTS OF THE V-22 ARE BEING STUDIED AND SHOW EXCITING PROMISE. NO PROCUREMENT FUNDS ARE REQUESTED FOR THE V-22 IN FY-87. RDT&E FUNDS ARE REQUESTED IN THE AMOUNT OF $386.8 MILLION.

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COMBAT SEARCH AND RESCUE (CSAR)/SPECIAL WARFARE SUPPORT

THE REVITALIZATION OF NAVY CSAR AND SPECIAL WARFARE SUPPORT IS RECOGNIZED AS AN ESSENTIAL REQUIREMENT AND IS PROGRESSING TOWARD THE NAVY'S GOAL OF PROVIDING A MISSION CAPABLE, COMBAT SURVIVABLE AIRCRAFT, WITH AN ABILITY TO EMBARK ABOARD A WIDE VARIETY OF SHIP PLATFORMS. ASSIGNED ENTIRELY TO THE NAVAL RESERVE, OUR PRESENT AIRCRAFT ARE OLD AND LIMITED IN CAPABILITY AND SURVIVABILITY. THE

V-22 TILT-ROTOR AIRCRAFT PROGRAM IS THE LONG-TERM SOLUTION AND WILL PROVIDE AN AFFORDABLE AND HIGHLY CAPABLE COMBAT SAR AND SPECIAL WARFARE WEAPONS SYSTEM. FIFTY V-22'S WILL BE DELIVERED TO THE NAVY COMMENCING IN FY-94 FOR TWO ACTIVE DUTY AND ONE RESERVE SQUADRON INCLUDING PIPELINE AND TRAINING AIRCRAFT. FULL OPERATIONAL CAPABILITY FOR NAVY CSAR AND SPECIAL WARFARE SUPPORT IS PROJECTED FOR FY-97 AND ALLOWS THE FORWARD DEPLOYMENT OF TWO OR THREE PLANE V-22 DETACHMENTS ON A PEACETIME ROTATION BASIS.

TO FILL THE VOID UNTIL THE MID-NINETIES, CONGRESS HAS AUTHORIZED A TOTAL OF $37.0 MILLION IN APN FUNDING TO PURCHASE NEW COMBAT SAR HELICOPTERS FOR THE NAVAL RESERVE. WE HAVE PROGRAMMED ADDITIONAL OUTYEAR FUNDING AND ARE ATTEMPTING TO ACCELERATE PROCUREMENT. WE ARE PURSUING A COMPETITIVE ACQUISITION STRATEGY TO PROCURE 18 INTERIM NAVAL RESERVE AIRCRAFT THAT ARE AFFORDABLE AND POSSESS A SUBSTANTIAL IMPROVEMENT IN MISSION CAPABILITIES NO LATER THAN FY-88/89.

WE HAVE AN ONGOING REQUIREMENT TO IMPROVE OUR CURRENT ACTIVE DUTY COMBAT SAR/SPECIAL WARFARE CAPABILITY. WE ARE IN THE PROCESS OF DETERMINING COST AND FEASIBILITY OF DEVELOPING MISSION KITS FOR RAPID INSTALLATION INTO FLEET HELICOPTERS AND INCREASING AIRCREW TRAINING IN THIS MISSION AREA TO PROVIDE A LIMITED COMBAT SEARCH AND RESCUE CAPABILITY UNTIL V-22 INTRODUCTION.

## CH/MH-53E SUPER STALLION

THE CH-53E IS A 3-ENGINE HELICOPTER DESIGNED TO LIFT 16 TONS. IT IS A SHIPBOARD COMPATIBLE, HEAVY TRANSPORT HELICOPTER CONFIGURED FOR BOTH MARINE AND NAVY MISSIONS. MARINE MISSIONS INCLUDE AMPHIBIOUS/HELIBORNE ASSAULT (PROVIDING FOR LIFT AND MOVEMENT OF CARGO AND TROOPS), AND HEAVY LIFT SHORE OPERATIONS (INCLUDING TACTICAL RECOVERY OF DOWNED OR DAMAGED AIRCRAFT AND EQUIPMENT).

NAVY MISSIONS INCLUDE VERTICAL ONBOARD DELIVERY (VOD) AND AIRBORNE MINE COUNTERMEASURES (AMCM). THE FIRST TWO MH-53E'S, THE AMCM VERSION OF THE CH-53E, ARE BEING DELIVERED IN 1986. THE MH-53E WILL HAVE SIGNIFICANTLY ENHANCED AMCM CAPABILITY OVER THE PRESENTLY DEPLOYED RH-53D. AMCM ASSOCIATED IMPROVEMENTS WILL ALSO ENHANCE THE AIRCRAFT'S ABILITY TO PERFORM UTILITY AND SPECIAL MISSIONS BY SIGNIFICANTLY INCREASING RANGE AND NAVIGATION CAPABILITY.

THE CH-53E INVENTORY AS OF 1 JANUARY 1986 IS 89 WITH 14 AIRCRAFT FUNDED AND UNDELIVERED. THE PROCUREMENT COST THROUGH THE BUDGET YEAR IS $2,181 MILLION. THE FY-87 REQUEST INCLUDES $236.6 MILLION FOR THE PRODUCTION OF 14 AIRCRAFT, 10 CH-53ES AND FOUR MH-53E'S. ADVANCE PROCUREMENT IN FY-85 THROUGH 88 REFLECTS A CONGRESSIONALLY APPROVED AIRFRAME MULTI-YEAR PROCUREMENT STRATEGY FOR FY-86 THROUGH 89 FOR PROCUREMENT OF 56 AIRCRAFT. THE RECURRING FLYAWAY COST OF THE CH/MH-53E IS $14.0 MILLION.

## E-6A TACAMO

THE E-6A IS A LAND-BASED DERIVATIVE OF THE COMMERCIAL BOEING 707-300 SERIES TRANSPORT AND THE E-3A AWACS AIRCRAFT. IT IS EQUIPPED WITH HIGH BY-PASS TURBO FAN (CFM-56-2A-2) ENGINES, EXTENDED ENVIRONMENTAL CONTROL PROVISIONS AND A SPECIAL MISSION AVIONICS SYSTEM CONSISTING OF A RECONFIGURED AN/USC-13(V)-21 TRANSCEIVER. THE MISSION OF THE E-6A IS TO PROVIDE A COMMUNICATIONS RELAY FOR EMERGENCY ACTION MESSAGE (EAM) DELIVERY TO THE FLEET BALLISTICS MISSILE SUBMARINES.

THE FIRST TWO E-6A AIRCRAFT WILL BE PROCURED IN FY-86 WITH REMAINING 12 AIRCRAFT FUNDED BETWEEN FY-87 AND FY-89. THE PROCUREMENT COST THROUGH THE BUDGET YEAR IS $366.2 MILLION. THE FY-87 REQUEST INCLUDES $329.4 MILLION FOR THE PRODUCTION OF THREE AIRCRAFT. THE RECURRING FLYAWAY COST OF THE E-6A IS $62.0 MILLION IN CONSTANT FY-84 DOLLARS.

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General, we will be happy to have your comments from the point of view of the Marines.

## STATEMENT OF LT. GEN. K.A. SMITH, DEPUTY CHIEF OF STAFF FOR AVIATION, U.S. MARINE CORPS

General SMITH. Thank you, Mr. Chairman and members of the committee.

First, I would like to state that Marine Corps aviation is a fully integrated partner in the naval aviation system. Admiral Wilkinson buys, equips, and maintains the airplanes for the Marine Corps, just like he does for the U.S. Navy, and the level of integration goes on.

In addition, we are a one-third partner in the Marine air, ground and logistics combat team that the Marine Corps forms when it goes to war. We serve two masters, and we do it well. We do it well largely due to the continued support of this committee.

Admiral Martin talked a few minutes ago about carrier presence in the Med. Since 1947, those carriers have been accompanied by a Marine amphibious unit. This is an air/ground logistics force composed of about 2,000 to 3,000 Marines, tanks, artillery, helicopters and gunships, which gives us the capability to project naval power ashore in any place that we may be called upon to do so.

I would also like to refer back to Admiral Martin's discussion on preparedness. The two airplanes newest to the Marine Corps inventory are the F/A-18 and the AV-8B. They are shining examples of what sound investment in engineering up front does for us. Their mission capable rates are 80 to 85 percent consistently. In real terms, overall Marine Corps readiness increases in the past 5 years mean an additional 12 Marine squadrons available on any given day for front line work.

Accompanying readiness is the need to fly and keep our pilots and air crews proficient and ready to go to war. In 1987, we will attain 85 percent PMR, which is equivalent to what our Navy counterparts fly. It is the highest readiness that we have been able to attain since Vietnam.

There are a few systems that I would like to highlight in particular. One is the TAV-8B, which is the trainer version of the AV-8B. It gives us the capability to transition directly a flight school student or an A-4, F-4 or helicopter pilot directly into the AV-8B without having to go through the steps of learning to fly the AV-8A first. TAV-8B is very important to us and it also gives us the additional capability to do some realistic night attack training, which will be a capability that I will talk to next.

That night attack system in both the F/A-18 and the AV-8B, gives us the capability to turn midnight into high noon, whenever and wherever it might be required. Night, under the weather, first hit, first pass capability is provided in both of those airplanes.

I don't get a chance to talk too much about some of the mundane things that put all of this hardware together for the Marine Corps. One of those items is the tactical air operations module [TAOM], a command and control piece of equipment that enables the air component commander to control, direct, and apply the air power for the Marine air/ground task force commander, no matter where

they are, or what the conditions might be. The TAOM is fully interoperable with the NATO Alliance and with other services.

The Air Force is a full partner in the procurement of the TAOM, and we believe that it is a giant step forward not only in capability but in the reduction of the logistics required to hold ground. It gives us twice the capability for one-third the investment in logistics.

The direct air support center, improved air support center, is a part of that system, and it is the control activities that directs the battlefield effort in placement of effort and support of ground forces.

In conclusion, I would like to say that in partnership with your support and the U.S. arm of naval aviation, we provide the capability for this country to go places and convince those who are willing to create mischief that they hadn't ought to be confronted or hadn't ought to take on the Navy-Marine Corps team.

I am prepared for your questions, sir.

Mr. STRATTON. Thank you very much, General.

Are there any questions?

## Prepared Statement of Lt. Gen. K. A. Smith

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I appreciate the opportunity to testify before this committee on behalf of Marine aviation. On this, the occasion of my second appearance before the committee, it is a pleasure to report that 1985 was an even more productive year than the superb year before. With the strong support of the Congress, Marine aviation continues to reach levels of preparedness across the capability spectrum which are unparalleled in Marine aviation's 75 year history. My purpose is to provide an overall assessment regarding the status of Marine aviation today, as well as highlight Marine aviation programs contained in the President's FY-1987 Budget proposal.

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The third function, assault support, is the capability which moves combat personnel, supplies, and equipment of the MAGTF by aviation means. Fixed and rotary wing aircraft are utilized to perform this task requiring a mix of performance characteristics and capabilities available in the CH-46E, CH-53, AH-1, OV-10, and KC-130 aircraft. Aerial refueling is conducted by the KC-130 and helicopterborne assault by the CH-46 and CH-53, to include troop transport, resupply, and medical evacuation. The V-22 assault aircraft under development is intended to replace the CH-46E.

Offensive air support, our fourth function, delivers timely firepower, when and wherever needed, against enemy installations, equipment, and personnel. A distinction is drawn between deep air support conducted at a distance from ground forces and close air support, which is inherently close to ground forces and a trademark of Marine aviation. Offensive air support is accomplished by a variety of attack aircraft intended to meet many demanding operational and environmental challenges. These aircraft are the A-6, F/A-18, and the AV-8. Close air support will become even more responsive with the introduction of the night attack initiative which is intended to expand the useful operational envelope of our aircraft.

Electronic warfare, the fifth function, is primarily conducted by the capable EA-6B. This function describes the efforts of aviation forces to determine, exploit, and reduce or prevent hostile use of the electromagnetic spectrum while retaining the same spectrum for friendly force utilization. HARM and Sidearm missiles, fired by our fixed wing and rotary wing aircraft to shutdown enemy radars, are also an integral part of electronic warfare.

The final function, command and control, is driven by the necessity of the aviation combat element to fully coordinate and integrate all the preceding functions. Command and control of aircraft and missiles may be best described as the synthesis of a multitude of tasks previously discussed. Nonetheless, the integration of all aircraft activities into a single, coordinated effort is accomplished using a variety of systems. The systems planned to continue this critical function include the Improved Direct Air Support Center (IDASC), the Tactical Air Operations Module (TAOM), and the Advanced Tactical Air Command Center (ATACC). Together these systems provide airspace and air traffic control, operational flexibility in the employment of aviation assets, and necessary coordination of the aviation combat element within the overall MAGTF concept of operation. Decoys for the TPS-32 and TPS-59 command and control radars provide a degree of survivability by attracting enemy anti-radiation missiles. These six functions represent the full capability required of Marine aviation.

Having briefly outlined Marine aviation requirements, let me emphasize that the Marine Corps is increasingly mindful of the trust placed upon us by the American people to ensure those resources invested are utilized in an efficient yet effective manner. Toward this end, review of our requirements is a continual and dynamic process. You may note with pleasure several adjustments which have been made both in programming equipment and refining our organizational structure. The intended goal is to provide the United States with a Marine Corps far more capable and prepared tomorrow than today.

Marine aviation preparedness has experienced a steady improvement over the past few years. For example, I reported last year that aircraft readiness had achieved record high levels. In 1985, these records were surpassed with a new overall

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Marine aviation preparedness has experienced a steady improvement over the past few years. For example, I reported last year that aircraft readiness had achieved record high levels. In 1985, these records were surpassed with a new overall

aggregate readiness record of 75 percent mission capable. Figure 1 graphically portrays the gradual rise over the past five years in aircraft mission capable readiness.

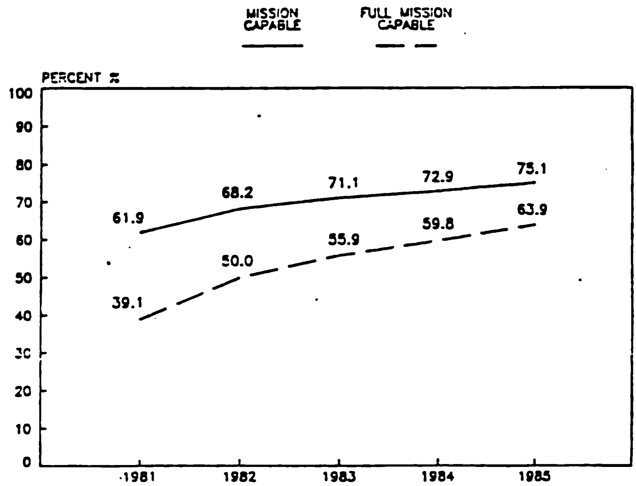


Figure 1 - Aircraft Readiness Rates

The most startling improvement, however, is reflected in the dramatic rise in the full mission capable rates also depicted in Figure 1. Full mission capable status indicates the availability of combat aircraft to perform the full range of tactical missions for which they were designed.

It has become axiomatic that the challenges posed by an increasingly sophisticated threat continually drive development of weapons systems technologically more advanced. This cycle of technological reliance to counter the threat has often, in the past, caused an adverse impact on aircraft full mission capable readiness. Although new aircraft being introduced to the fleet today continue to possess the latest affordable technology, they also reflect a conscious and concerted effort to design systems

which are reliable and maintainable. For example, the F/A-18, a sophisticated frontline strike fighter, averaged 85 percent mission capable and 82 percent full mission capable for the year 1985. The AV-8B, in its first year of introduction, demonstrated an equally impressive 85 percent mission capable rate while achieving a 79 percent full mission capable rate for 1985.

These high levels of aircraft readiness are a testimony to aircraft design as well as to the professionalism of the men and women who operate and maintain these aircraft. The level of dedication these individuals demonstrate on a daily basis is extraordinary. The difficult circumstances under which they work make their collective achievements even more remarkable. Enthusiastic and purposeful, these young Marines must be provided the necessary incentives required to ensure their invaluable skills are retained. Certainly, no greater inducement can be provided than the continued support of the Congress for quality of life improvements. This single commitment is a necessary incentive to retain their invaluable skills.

Building on the innate skills of our Marines, training ensures the expertise required to operate and maintain today's sophisticated aircraft and equipment is fully developed. Marine Aviation Weapons and Tactics Squadron-One (MAWTS-1) provides a superb example of a training initiative which has made a significant and positive impact on the combat proficiency of Marine aviation. MAWTS-1 is chartered to provide graduate level training in aviation tactics and techniques to already highly qualified Marine aircrewmen. Upon completion of the course of instruction, these Marines, designated Weapons and Tactics Instructors return to their parent organizations to pass on their knowledge to other Marine aircrews.

A major contribution to the preparedness of Marine aviation has been the continued funding by the Congress of the Flying Hour Program. This program represents the major means of upgrading and maintaining the readiness of our aircrews much like the full mission capable and mission capable rates do for our aircraft. We have used the same building block approach to accomplish increases in both areas. In 1985, we flew over 350,000 hours which resulted in a significant and measurable increase in aircrew combat readiness. The flying hour request of 369,528 hours for FY-1987 is required to carry on this program and will increase Marine Corps capability. Today, our aircrews are at their best state of readiness since Vietnam. In order to continue to be capable of providing combat ready aircrews on short notice, Marine aviation squadrons must maintain a uniform readiness posture. Your support is crucial to the continuation of this readiness improvement program.

The role of aviation safety in conservation of irreplaceable men and costly equipment continues to challenge our operating forces. Overall, the accident rate for 1985 reflects a slight increase over the historic low rate of 4.63 per 100,000 flight hours demonstrated in 1984. The 1985 mishap rate was 5.23 mishaps per 100,000 flight hours. The high level of full mission capable aircraft, and the improved Flight Hour Program contribute in a major way to an overall downward 10 year trend in aircraft mishaps. However, Marine aviation continues to be profoundly concerned with loss of lives and equipment. As a Corps we continue to adopt initiatives which should support further reductions in the mishap rate. Some of these safety initiatives include early identification and documentation of unsatisfactory aeronautical performance, improved dissemination of safety related information, and closer cooperation between aircraft manufacturer and operator. As an example, a mishap pamphlet for each aircraft in our current inventory will be prepared by the Naval Safety Center for distribution to all aircrews. These

pamphlets describe factors which have led prior aircrews to mishaps and are an attempt to prevent recurrence.

Turning to the future, the V-22 development program remains the Marine Corps' highest aviation priority. The strong congressional support expressed in the FY-1986 Budget has enabled the Department of the Navy (DON) to move forward with development of this vital program. As we rapidly approach the 1990's, our current medium lift aircraft, the CH-46, which has been in the fleet since 1965, will become increasingly unable to perform the pivotal role. Introduction of the V-22 is essential to maintaining a credible amphibious lift capability. The strategic and tactical applications of the V-22 far exceed the speed and range capabilities of existing CH-46 fleet of assault support aircraft. Independent of critical sealift and airlift, the V-22 may be strategically deployed over an unrefueled range of 2100 nautical miles. This capability enables timely marriage of aviation forces with those ground elements assigned to Maritime Pre-positioning Ships (MPS) brigades. The net effect is a "force multiplier" and a decrease in strategic airlift reliance.

The V-22 permits rapid unprecedented buildup of combat power ashore which is an established and fundamental principle of amphibious and vertical assault operations. American Marines may be employed well in advance of a combined surface assault to isolate the objective area and block potential counterattacking enemy forces. The V-22 capability of lifting 24 combat loaded Marines or 10,000 pounds of cargo reduces, by almost half, the time required to deliver the same load today. As the 250 knot cruise speed of the V-22 reduces the time between assault waves, it markedly improves force survivability through rapid buildup of combat forces in the early stages of assault operations. Equally important, these same performance characteristics will enable combat forces to reduce their vulnerability through dispersion,

yet maintain the ability to rapidly concentrate combat power at the decisive time and place.

Negotiations recently concluded have led to an agreement on both airframe and engine development contracts under a total $2.5B development cap. A fixed price incentive contract for a not to exceed cost of $1.8B has been reached with the Bell-Boeing team. The airframe contract will produce six flight and three ground test articles. An additional feature requires a firm fixed price contract with options for a not to exceed cost on each of the first four production lots. The engine contract was awarded to Allison for the lease of 21 engines at a cost of $76.4M. In both cases, contracts were negotiated to ensure the V-22 is developed in the most economical fashion, while at the same time maintaining required capabilities.

Another economic consideration focuses on the inherent technology utilized in the V-22. While the V-22 is intended to initially be procured as a medium assault aircraft, it incorporates many of the technological features found in modern high performance aircraft. For example, composites and digital fly by wire technologies are being utilized to optimize overall performance and reliability.

Although the Department of the Navy is sponsoring the development of the V-22, the joint procurement program involves all four armed services. An initial buy of 913 aircraft provides the Marine Corps with 552, the Army with 231, the Air Force with 80, and the Navy with 50 aircraft. As the performance of the V-22 is fully realized in development, we are confident these initial procurement levels represent only a fraction of the combined services' requirement. Within the Department of the Navy alone, potential mission applications, including anti-submarine warfare, are being examined. Also, the application of tiltrotor to civil aviation is unbounded. The V-22 is our number

one priority because it offers a significant enhancement and sustains the capability to conduct future amphibious operations.

The AV-8B represents another aircraft whose unique characteristics are particularly applicable to the expeditionary environment of amphibious operations. The Congress may be justifiably proud of the key role it played in AV-8B development. Uninhibited or restricted by fixed airfields, the AV-8B provides timely and accurate close air support to engaged ground forces. Flexible basing opportunities enable it to be dispersed and operated from several geographically separated sites, thereby decreasing aircraft vulnerability to enemy attack and improving responsiveness. A total of 328 AV-8B's are to be procured and distributed across the 8 light attack squadrons and one training squadron in the Marine Corps. Each attack squadron will operate 20 aircraft. Two squadrons are now operational, and a third squadron will transition in April of 1986. As the fourth squadron receives the AV-8B in FY-1987, conversion of existing AV-8 A/C aircrews will have been completed.

This coincides with the July 1987 introduction of the TAV-8B, a two-seat trainer aircraft for transitioning A-4 pilots and flight school graduates. The 28 total TAV-8B aircraft requirement is considered essential to safe transition of light attack aircrews and flight school graduates new to VSTOL operations. Over 90 percent commonality exists between the AV-8B and the TAV-8B, which considerably lowers developmental risk. TAV-8B development is proceeding on schedule with the first flight set for December 1986.

In our fighter squadrons, introduction of the F/A-18 has been superb in every way. The F/A-18 is equally capable in either fighter or attack roles, and it offers the promise of being one of the most versatile aircraft ever introduced. Reports from

fleet commanders, Navy and Marine Corps alike, extol the virtues of this remarkable aircraft and the manner in which it has been introduced into the fleet.

Today, three Marine F/A-18 squadrons are operational on the west coast with two of those squadrons currently deployed aboard the USS CORAL SEA in the Sixth Fleet. On the east coast, one F/A-18 squadron is operational with two more squadrons transitioning this year and two squadrons forming in FY-1987.

The versatility of this aircraft has provided the Marine Corps a unique opportunity to reorganize our existing fighter (VMFA) squadrons to capitalize on the F/A-18's inherent flexibility. With the introduction of the two-seat F/A-18, the existing 12 aircraft VMFA squadron will be increased to 16 aircraft. The Tactical Air Controller (Airborne)/Forward Air Controller (Airborne) and reconnaissance missions are to be assumed by the new organization. The eight single-seat and eight two-seat F/A-18's in each squadron will all be austere all-weather capable -- a feature born out of the current Night Attack Development Program.

The Night Attack Development Program provides a vital night and under-the-weather capability which enhances the already formidable capability resident in the F/A-18 and the AV-8B. By capitalizing on the advantages of darkness, the night attack program increases aircraft survivability while overcoming many of the obstacles associated with night combat operations. The low cost of this program is accomplished by developing components for the AV-8B which will also be utilized in the F/A-18. Costs associated with AV-8B equipment common to the British GR-5 aircraft are reduced through shared United Kingdom and American development funding.

The system integrates several separate components enabling an aircraft to be operated during darkness at low altitudes. First, a cockpit with night vision goggle compatible lighting enables a pilot with night vision goggles to maneuver at low altitude at night. Second, a navigational forward looking infrared (FLIR) device allows precise identification of terrain features and enemy forces. Third, a moving map display is included to further reduce the potential for disorientation common to low altitude and reduced visibility operations. Finally, a rasterized heads up display (HUD) is included which displays forward FLIR information allowing out-of-cockpit orientation.

Continued congressional support is required to complete the timely development of the Night Attack system for incorporation into future AV-8B and F/A-18 production models. The Night Attack system is scheduled to be included in the FY-1987 procurement of the AV-8B and the FY-1988 procurement of the F/A-18. Future funding reductions would force a costly retrofit to ensure this capability is available in sufficient numbers. This austere feature complements the true all weather capability which is existent only in the A-6 series aircraft.

The A-6F development program is designed to ensure an all weather capability remains credible in the year 2000 and beyond. Current planning is for procurement of 150 production A-6F aircraft to be complemented by a modification program which could include up to 140 aircraft. The Marine Corps is to receive its first A-6F in 1993.

The CH-53E is approaching the third year of a four year multiyear procurement program. The CH-53E is the latest of the successful CH-53 series of aircraft which have provided assault support heavy lift for the Marine Corps. The CH-53E is essential to helicopter lift of the Light Armored Vehicle and the M-198

fleet commanders, Navy and Marine Corps alike, extol the virtues of this remarkable aircraft and the manner in which it has been introduced into the fleet.

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# BRADLEY FIGHTING VEHICLES SYSTEMS

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HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
PROCUREMENT AND MILITARY
NUCLEAR SYSTEMS SUBCOMMITTEE,
*Washington, DC, Wednesday, May 21, 1986.*

The subcommittee met, pursuant to notice, at 10:00 a.m., in room 2118, Rayburn House Office Building, Hon. Samuel S. Stratton (chairman of the subcommittee) presiding.

## STATEMENT OF HON. SAMUEL S. STRATTON, A REPRESENTATIVE FROM NEW YORK, CHAIRMAN, PROCUREMENT AND MILITARY SYSTEMS SUBCOMMITTEE

Mr. STRATTON. The subcommittee will come to order.

This morning the subcommittee will receive testimony regarding the live-fire tests of the Bradley Fighting Vehicle. Our distinguished witnesses today are Hon. John O. Marsh, Jr., Secretary of the Army, former Member of the House of Representatives; Gen. John Wickham, Jr., Chief of Staff of the Army; Hon. James Ambrose, Under Secretary of the Army; and Hon. Donald A. Hicks, Under Secretary for Research and Engineering in the Department of Defense.

The Bradley Fighting Vehicle has become a very controversial program here in the House of Representatives 7 years after it has gone into production, and now we find ourselves arguing as to whether this is the right vehicle for the infantry or whether we should scrap it. We need to understand exactly what this vehicle is intended to do and what alternatives exist if the program were to be terminated as some Members have suggested.

Yesterday the subcommittee received a briefing on the staff inquiry of the Bradley live-fire test program, and tomorrow the committee will be releasing the staff report. The question of live-fire testing is one that has been largely focused on in the House of Representatives as a criticism of the adequacy of the Bradley Fighting Vehicle, and hence this is the key problem at the present time.

In connection with this test program, the problem is the inability of the Office of the Secretary of Defense and the Army to resolve the basic testing issues to date. This problem is not unique. This is precisely the same situation that the Department of Defense faced last year with the DIVAD test program, and that is no agreement whatsoever on the criteria for the testing and no agreement on the basic test methodology. In fact, we still don't have—a year later—anything to supply air defense for our troops in Europe, as a result of the failure to agree on how the DIVAD was to be tested.

This subcommittee cannot accept a test program where agreement does not exist on the fundamental test issues prior to the initiation of tests, and where the control of the Office of the Secretary of Defense is lacking. The committee cannot be expected to consider favorably any request for procurement of the Bradley with the testing process in such disarray.

Therefore, we require that the Department of Defense report to this subcommittee not later than June 6, 1986 with an OSD-approved detailed test plan for the Bradley phase 2 live-fire tests. The subcommittee would expect that the testing would not resume until an approved, detailed plan does exist.

The purpose of this hearing today, in particular, is to understand the Army's commitment to the Bradley. During all of these attacks that have been made in the House of Representatives, there has been no one, no senior officer of the Department of the Army, who has spoken out in defense of the Bradley. We have had a Major Soucy from time to time who was responding to the critics in the House, but we need to get the story from the top leadership of the Army, and that is what the subcommittee is trying to do.

Before we call on our witnesses, I would yield to the gentlewoman from Maryland to make whatever statement she would like to make.

## STATEMENT OF HON. MARJORIE S. HOLT, A REPRESENTATIVE FROM MARYLAND, RANKING MINORITY MEMBER, PROCUREMENT AND MILITARY NUCLEAR SYSTEMS SUBCOMMITTEE

Mrs. HOLT. Thank you, Mr. Chairman.

I certainly join you in welcoming our distinguished witnesses to this hearing on the Bradley Fighting Vehicle. This subcommittee is deeply concerned about the status of the Bradley. We are especially concerned about the vehicle's test program.

The recent DIVAD experience serves as a constant reminder to all of us what can happen to a program that becomes embroiled in a testing dispute. I felt that that was really a terrible thing to have happen, just to wipe out the DIVAD program.

In the case of the Bradley there is no question that it has met its specifications. Questions have been raised, however, about the Bradley's vulnerability. Answers to those questions are certainly needed. The test program should provide those answers. Unfortunately, the test program has been suspended because of lack of agreement over methodology and procedure.

In the current budget climate—you know it as well as we do—it is essential that a comprehensive, agreed-upon test program resume as quickly as possible. Otherwise, we face the prospect of killing a needed program without a viable alternative. Yes, without a valid, credible test program, the Bradley in all likelihood would remain suspended in a state of limbo or terminated as the DIVAD was.

I look forward to receiving the testimony and to getting on with a valid test of this weapons system. Thank you very much.

Mr. STRATTON. Thank you, Mrs. Holt.

Secretary Marsh, would you give us your statement at this time?

Secretary MARSH. Thank you, Mr. Chairman. I would like to——

Mr. STRATTON. Oh, I guess probably we will have to recess for 10 minutes to respond to the decisive problem of whether the journal for yesterday should be approved, and we will come back as soon as possible.

I take that back. It is a vote to raise the ceiling on the Veterans Administration.

[Recess taken.]

Mr. STRATTON. The subcommittee will come to order.

Mr. Secretary, we would appreciate your statement at this time.

## STATEMENT OF HON. JOHN O. MARSH, JR., SECRETARY OF THE ARMY, ACCOMPANIED BY GEN. JOHN A. WICKHAM, JR., CHIEF OF STAFF OF THE ARMY; MR. AMBROSE, UNDER SECRETARY OF THE ARMY; AND DR. DONALD A. HICKS, UNDER SECRETARY FOR RESEARCH AND ENGINEERING, DEPARTMENT OF DEFENSE

Secretary MARSH. Thank you, Mr. Chairman. I am grateful to you and members of the subcommittee for giving us this opportunity to appear before the subcommittee to set forth the Army's position in reference to the Bradley Fighting Vehicle and our support for it.

Mr. STRATTON. I think you better pull the mike a little closer there. It doesn't seem to be carrying.

Secretary MARSH. What I would like to do, with the Chair's permission, is to file the statement that I have prepared and then seek to summarize it for the purposes of the hearing.

With me this morning is the Chief of Staff of the Army, General Wickham. General Wickham is in a position to address the tactical employment of the Bradley, which is a very significant dimension of the vehicle. The Under Secretary of the Army, Mr. Ambrose, is in a position to discuss the technical dimensions and aspects of the vehicle, its technical capabilities and performance, and also the testing that has been undertaken to date. Of course, also with me is the Under Secretary of Defense, Dr. Hicks, who has been very helpful and very cooperative to the Department of the Army. He can speak for the Department of Defense in reference to the new live fire testing of the vehicle.

I would mention to you, Mr. Chairman, that both General Wickham and myself, and particularly General Wickham, in posture hearings have pointed out to congressional committees the need and the role of the Bradley. This hearing is important to us because it gives us an opportunity to clarify some of the misunderstandings about the vehicle, and to set forth our support for its continued vital role in our modernization program.

As you know because of your background and experience, armored tactics have been influenced largely by the events of World War II in all armies of the world. We see that although the ancient maxim of the infantry being required to take and hold ground has remained unchanged, the method in which the infantry moves to achieve that objective has changed on the modern battlefield.

We know that because of World War II and in subsequent conflicts, particularly the 1973 Arab-Israeli conflict, that it is essential that the infantry be able to move very quickly to exploit the ad-

vances that have been achieved by heavy armor. In order to do that on the modern battlefield, they must have some degree of protection both from small arms, artillery fragments, and to a certain extent mines.

Out of this would come the armored personnel carriers which you are very familiar with. These we see have a multifaceted function. One is to carry a squad of infantry soldiers; second, to be able to provide suppressing and supporting fires for that infantry in a deployed mode; as well as be a platform for an antitank weapon.

We believe that the Bradley eminently meets those requirements. It is our position that the Bradley is superior to any other vehicle of its type in any army of the world, including the MARDER system in the German Army and the BMP, both current and upgraded versions, in the Soviet Army. If I could, let me show these different vehicles so that we have some idea of what we are looking at.


Here you see an earlier version of the Soviet BMP, a vehicle that has a crew of about 10 men. Seven are infantry and there are three more in the crew. The vehicle has a 73-millimeter low-velocity cannon mounted on it. It has the capability of firing small arms from the side ports and from a rail, a Sagger antitank missile. It is a tracked vehicle that you will see in different forms in other armies.

## BMP–2


ROADSPEED: 65 KM/H

CBR: DETECTION, FILTRATION, AND PROTECTION

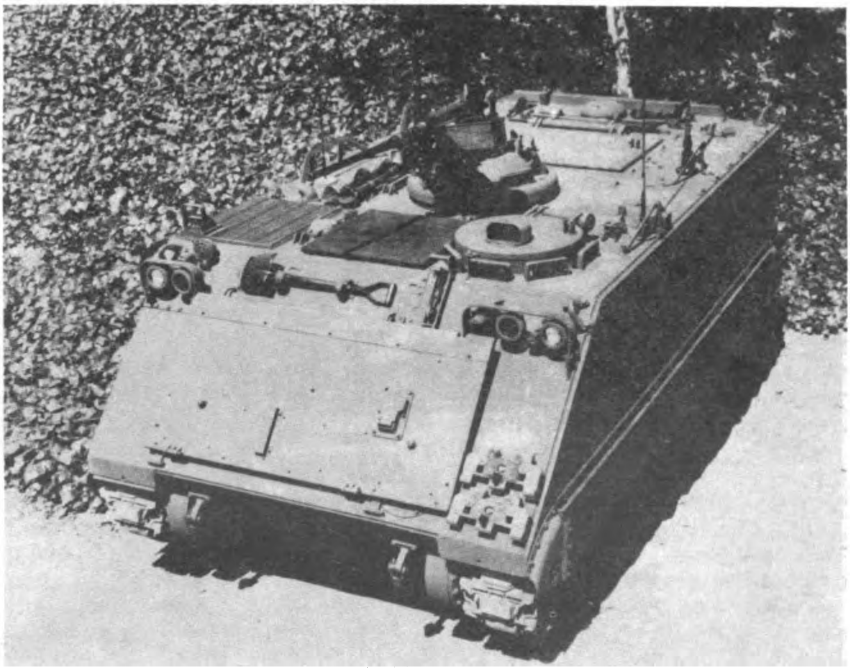
CREW: 3

PASSENGERS: 7–MAN SQUAD

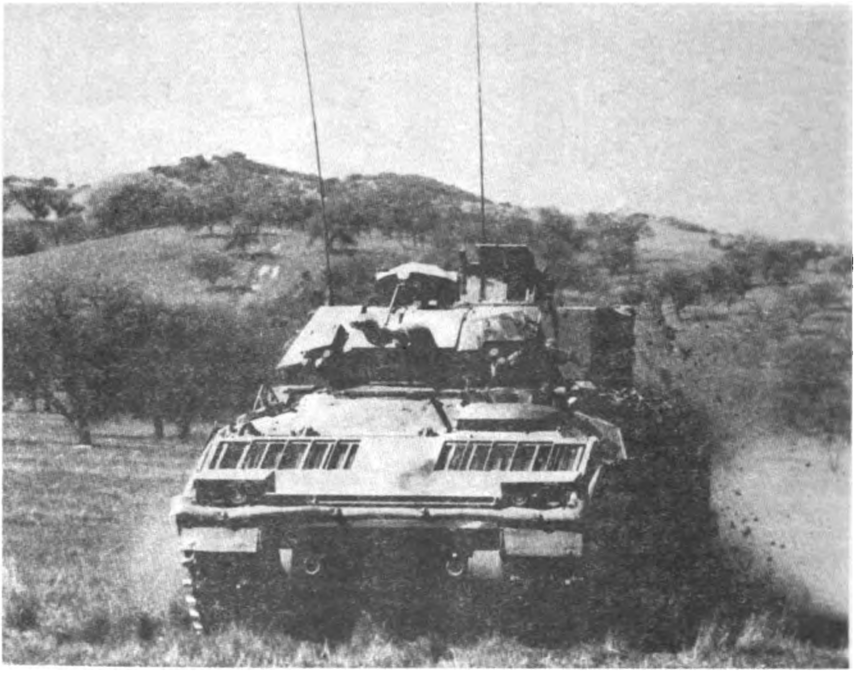
WEAPONRY:
30 MM MAIN CANNON
FOUR ATGM
7.62MM MACHINE GUN
GRENADE LAUNCHER
AIR DEFENSE MISSILE

This slide shows that the Soviets have moved into a BMP vehicle that has done away with the 73-millimeter cannon. They now have a 30-millimeter gun on the vehicle. It still has a crew of 10, although there is some conjecture that that crew number may be reduced by 2. It also has a 7.62-mm machinegun, a grenade launcher and an antitank guided missile.

Here you see the German MARDER, a 60,000-poúnd vehicle. It also has a gun on it. It is a very good vehicle but, is, as I mentioned, heavier than the Bradley.



If you see the development of the American armored personnel carriers, you would first see the M-113, and I show you the M-113 because, one, it does not have a turret on it. Second, it does not have the gun system that we have on the Bradley and except in the improved TOW vehicle [ITV] version, it does not have the same antitank capability.



To contrast that, you now see the Bradley, which is the subject of this discussion. I would say to you that in a cross-country mode, the Bradley is faster, it has a stabilized turret, and it has a sighting system that gives it more of an all-weather capability, particularly for operations at night.

If you look at all these vehicles, there is a certain commonality to them. One, they are lighter than tanks, and although sometimes they are perceived or misconstrued to be tanks and are interpreted as being a tank, they are not. Second, all of them are very fast and mobile. Most of them are constructed from heavy aluminum or steel. Almost all of them are tracked, although that is not necessarily the case. There are some wheeled vehicle armored personnel carriers in various other Army inventories.

Now questions have been raised and should be raised about the survivability of the Bradley. Let me make an observation in a general way from my vantage point as the Secretary of the Army. There has been a history, fortunately, in our Armed Forces that survivability and the production of equipment that enhances survivability is an ethic or ethos of American arms. I hope that will always be the case, and I am convinced it is very apparent in the production of the Bradley.

Survivability is a dominant factor in the planning of our military planners and it is also in the thinking of our military leaders. There are many historical examples of how we will expend ammunition and munitions to put rings of fire around isolated units until they can be extracted and to protect wounded soldiers. Those examples are as they should be because we look on the expenditure of

arms and munitions as being much the type of thing that we should do, rather than the expenditure of lives. There are many examples of that and I have seen those examples myself.

In the present instance there may be differences of view about these vehicles, and there may have been errors of judgment on both sides. I am sure that there have been errors in judgment by the Army, but I am convinced that those who have had a responsibility for the prosecution of the program have pursued their task on the basis of trying to do what they really believe is best for the American soldier, the U.S. Army, and their country. I have no reason to question either their integrity or their purpose, and I emphasize that to the committee.

Now there is an element of this that we have to be realistic about, and that is the modern battlefield. The modern battlefield is a very dangerous place to be. It is likely to be covered with heavy antitank weapons systems. There is going to be enormous firepower out there. There are going to be a multiplicity of flat-trajectory, high-velocity-type weapons with different types of warheads with enormous penetration capabilities. There are going to be air-to-ground missiles, and it is going to be a very dangerous environment for anything that is on that ground, whether it is a Bradley, a MARDER, a BMP, or whatever. In fact, any heavy tank that happens to be in that environment in such circumstances is likely to find itself in harm's way. The Bradley is no exception to this.

I would emphasize to the committee and to the Congress of the United States that the best protection of the Bradley, the best insurance for its survival, is the tactical knowledge and know-how of the battalion commander and the company commander. How they employ that vehicle on the battlefield, to include the use of terrain, the use of artillery fire and tactical air support in conjunction with the commander's maneuver plan will determine its survivability.

The doctrine for battlefield employment of mechanized infantry remains virtually unchanged. Armored personnel carriers and Bradley Fighting Vehicles are not tanks. There is a continuing need for their mobility in pursuit, as well as in the defense. The Bradley must be able to have protection from small arms fire as well as artillery fragments.

The Bradley, if you look at it, takes advantage of much technology in its development. It has greater mobility, greater agility and greater firepower than the M–113. It has a stabilized turret system, and it has certain driving and operations and sighting capabilities that enable it to function quite well in adverse weather conditions, particularly at night. The 25mm gun that is there gives it a suppression capability and a firing platform that is enormously helpful to an infantry force.

Now, as you are aware, one of the purposes of this hearing is to address a number of the tests to which the Bradley has been or is about to be subjected. Let me just remind the committee that, as Congresswoman Holt pointed out, the Bradley in the late 1970's was production tested, and it was tested to the design specifications. Those tests indicated that the Bradley met the specifications for which it was designed. It was tested against 7.62 and 14.5mm machine gun type fire and artillery fragments of the 155mm, and it met the requirements in those tests.

The current tests that we are now addressing are divided into two parts. We are hopeful that these tests—and we welcome these results—will show us other ways to enhance the survivability of that vehicle. The second series of tests have not been completed. I would say to the committee, the question is not one of being reluctant to test. It is the attitude in the Army, and I think in the Department of Defense, to try to be responsive as to what it is that is desired to be tested and what is the best way to achieve those results.

The Bradley—and it has been demonstrated in these tests—is a better vehicle than the M-113 which is currently in the inventory, that we are using as an armored personnel carrier. It is better than its counterpart in the Soviet Union, the BMP, but when you put it up against heavy overmatching fires, you are going to find that none of these vehicles are going to be able to be completely survivable. On the questions of troop mobility and protection and firepower, I think you will find, as I have said, that it is an outstanding system.

I would direct the attention of the committee to some of the results of the use of Bradley at the National Training Center. We are beginning to get back a number of examples now where the Bradley has shown a demonstrable advantage and difference in the outcome of those exercises, which are the closest thing to a real combat situation that you can possibly have. I believe that an examination of these results of the use of the Bradley will justify the committee's support of the vehicle.

It is a pleasure to be here. We appreciate very much this opportunity. We need the vehicle. We appreciate the support that you have given us, Mr. Chairman, and your committee, in the years, and we welcome the questions you might direct to us. As I said, on areas that relate to tactics and to testing and vehicle specifications, I will refer those to the experts who are here with me, sir.

[Secretary Marsh's, General Wickham's, and Dr. Hicks' prepared statements follow:]

PREPARED STATEMENT OF HON. JOHN O. MARSH, JR. AND GEN. JOHN A. WICKHAM, JR.

MR. CHAIRMAN, MEMBERS OF THE SUBCOMMITTEE.

THANK YOU FOR THIS OPPORTUNITY FOR GENERAL WICKHAM AND ME TO APPEAR BEFORE YOUR SUBCOMMITTEE IN SUPPORT OF THE ARMY'S REQUEST FOR THE BRADLEY VEHICLE.

THIS ALSO PROVIDES AN OPPORTUNITY, HOPEFULLY TO CLEAR THE AIR ON CERTAIN MISUNDERSTANDINGS ABOUT THIS VEHICLE, AND TO EMPHASIZE THE NEED FOR ITS CONTINUED PROCUREMENT AS A PART OF OUR ESSENTIAL MODERNIZATION PROGRAM.

AS YOU ARE AWARE, ARMORED TACTICS, RESULTING PRINCIPALLY FROM WORLD WAR II, HAVE HAD A SIGNIFICANT IMPACT ON FORCE STRUCTURE AND EQUIPMENT IN MODERN ARMIES OF THE WORLD. THE ANCIENT MAXIM ON THE ROLE OF THE INFANTRY TO TAKE AND HOLD GROUND REMAINS UNCHANGED. HOWEVER, THE METHODOLOGY BY WHICH THE INFANTRY IS MOVED ON THE MODERN BATTLEFIELD HAS CHANGED.

WORLD WAR II AND SUBSEQUENT CONFLICTS, INCLUDING THE ARAB-ISRAEL WARS, HAVE DEMONSTRATED THE NEED FOR INFANTRY THAT CAN BE MOVED QUICKLY TO EXPLOIT THE ADVANCES OF HEAVY ARMOR. A SUCCESSFUL DEPLOYMENT OF THE INFANTRY HAS PLACED A PREMIUM ON PROTECTION FROM SMALL ARMS FIRE, MORTAR AND ARTILLERY FRAGMENTS, AND TO SOME EXTENT MINES. THIS LED TO THE DEVELOPMENT OF THE ARMORED PERSONNEL CARRIER (APC), AND FROM THE ARMORED PERSONNEL CARRIERS HAVE EVOLVED THE FIGHTING VEHICLE WHICH HAS A TWO FOLD FUNCTION:

•• FIRST TO CARRY A SQUAD OF COMBAT INFANTRY; AND,

•• SECONDLY TO HAVE THE CAPABILITY OF PROVIDING, SUPPRESSING, AND SUPPORTING FIRES FOR THAT INFANTRY, AS WELL AS FUNCTION AS A PLATFORM FOR AN ANTI-TANK WEAPON.

THE BRADLEY, AS YOU KNOW, IS DESIGNED TO MEET THAT NEED. OTHER FIGHTING VEHICLES ARE FOUND IN THE MARDER SYSTEM IN GERMANY, AND THE BMP IN THE SOVIET ARMY. OTHER EXAMPLES COULD BE CITED.

THESE VEHICLES HAVE A CERTAIN COMMONALITY:

•• FIRST THEY ARE LIGHTER THAN TANKS;

•• THEY ARE LESS HEAVILY ARMED;

•• THEY ARE FAST;

•• THEY ARE CONSTRUCTED OF HEAVY ALUMINUM AND STEEL; AND,

•• THEY ARE USUALLY TRACKED.

QUESTIONS HAVE BEEN RAISED ABOUT SURVIVABILITY, AND LET ME SPEAK TO THOSE.

FIRST, THERE HAS BEEN A HISTORY IN OUR ARMED FORCES OF SEEKING TO PROVIDE EQUIPMENT AND EXPEND RESOURCES TO ENHANCE SURVIVABILITY AND REDUCE TROOP EXPOSURE.

I CAN TELL YOU AMONG OUR PLANNERS OF WEAPONS SYSTEMS, NEARLY ALL OF WHOM HAVE HAD EXPERIENCE AS MIDDLE LEVEL COMBAT LEADERS IN VIETNAM, SURVIVABILITY HAS BEEN STRONG AND A CONTINUING CONSIDERATION OF THE BRADLEY. THERE MAY BE DIFFERENCES OF VIEW AND THERE MAY HAVE BEEN ERRORS OF JUDGMENT, BUT THEY HAVE PURSUED THEIR TASKS ON THE BASIS OF TRYING TO DO WHAT IS BEST

FOR THE SOLDIER AND THE ARMY. I HAVE NO REASON TO QUESTION THEIR INTEGRITY OR PURPOSE.

HOWEVER, THE MODERN BATTLEFIELD WITH SOPHISTICATED ANTI-TANK WEAPONS SYSTEMS AND ENORMOUS FIRE POWER, A MULTIPLICITY OF OTHER LONG RANGE FLAT TRAJECTORY AND HIGH VELOCITY WEAPONS WITH IMPROVED WARHEADS, AND AIR TO GROUND MISSILES, CREATES A DANGEROUS ENVIRONMENT FOR ANY TYPE VEHICLE. THE BRADLEY WAS NOT INTENDED TO WITHSTAND THESE KINDS OF OVER-MATCHING FIRES NOR IS ANY ARMORED PERSONNEL CARRIER OR FIGHTING VEHICLE OF ANY ARMED FORCE. IN FACT, HEAVY ARMOR IN SUCH A CIRCUMSTANCE COULD BE IN HARM'S WAY.

THE BEST PROTECTION OF THE BRADLEY DEPENDS UPON THE TACTICAL KNOWLEDGE OF THE BATTALION COMMANDER AND THE COMPANY COMMANDER, AND HOW THEY DEPLOY THE VEHICLE ON THE BATTLEFIELD, TO INCLUDE THE USE OF TERRAIN AS WELL AS ARTILLERY FIRES, AND TACTICAL AIR SUPPORT IN CONJUNCTION WITH THE COMMANDER'S MANEUVER PLAN.

DOCTRINE FOR BATTLEFIELD EMPLOYMENT OF MECHANIZED INFANTRY REMAINS ESSENTIALLY UNCHANGED SINCE ARMORED

PERSONNEL CARRIERS WERE INTRODUCED MANY YEARS AGO. ARMORED CARRIERS OR FIGHTING VEHICLES ARE NOT TANKS, RATHER THEY PROVIDE MOBILITY AND PROTECTION AGAINST SMALL ARMS, AS WELL AS ARTILLERY FRAGMENTS, FOR THE INFANTRY, WHICH FUNCTIONS IN A MOUNTED AS WELL AS DISMOUNTED ROLE AS PART OF THE COMBINED ARMS TEAM.

WHILE DOCTRINE HAS NOT CHANGED, TECHNOLOGY HAS ENABLED THE ARMY TO FIELD A FIGHTING VEHICLE WITH INCREASED MOBILITY AND A NIGHT/LIMITED VISIBILITY FIGHTING CAPABILITY COMPARABLE TO THE M-1 TANK AND WITH TOW ANTI-TANK AS WELL AS 25MM GROUND AND AIR SUPPRESSIVE FIREPOWER, ALL OF WHICH SIGNIFICANTLY ASSIST THE INFANTRY IN ITS MISSION AGAINST THREAT FORCES WHICH HAVE INCREASED LETHALITY. MOST MODERN ARMIES HAVE INFANTRY FIGHTING VEHICLES WITH CAPABILITIES SIMILAR TO THOSE OF THE BRADLEY, AND AS TECHNOLOGY WARRANTS, THEY ARE PRODUCT IMPROVING THEIR VEHICLES.

AS YOU KNOW, THE BRADLEY HAS UNDER GONE A SERIES OF TESTS. THERE ARE MORE TO BE CONDUCTED.

THE CURRENT TESTING PROGRAM IS DIVIDED INTO TWO PHASES. THESE TESTS HAVE BEEN STRUCTURED AND APPROVED BY THE OFFICE OF TEST AND EVALUATION IN THE DEPARTMENT OF DEFENSE.

ALTHOUGH PHASE TWO OF THE TESTING HAS NOT BEEN COMPLETED, NEVERTHELESS, CERTAIN CONCLUSIONS CAN BE DRAWN ABOUT THE BRADLEY. IT PROVED ITSELF SIGNIFICANTLY BETTER THAN ITS PREDECESSOR, THE M-113 AND THE SOVIET COUNTERPART THE BMP. I BELIEVE THE TESTS WILL ALSO SHOW THAT THE BRADLEY'S ABILITY TO TAKE OVER MATCHED FIRES, SUCH AS A TOW EQUIVALENT, WAS GENERALLY BETTER THAN HAD BEEN ANTICIPATED. THE TESTS INDICATED CERTAIN MODIFICATIONS THAT COULD BE MADE TO FURTHER ENHANCE ITS SURVIVABILITY.

ON QUESTIONS OF MOBILITY, TROOP PROTECTION AND FIRE POWER, IT CONTINUES TO PROVE ITSELF BETTER THAN

ANY OTHER FOREIGN COUNTERPART. EXERCISES AT THE NATIONAL TRAINING CENTER, WHICH ARE THE CLOSEST THING TO REAL WAR, FURTHER CONFIRM THAT WHEN IT IS EMPLOYED, USING PROPER TACTICS IN CONCERT WITH THIS COMBINED ARMS TEAM, THAT IT IS HIGHLY EFFECTIVE AND A CLEAR IMPROVEMENT FOR OUR FORCES WHEN COMPARED TO THE M-113 WHICH IS SLOWER, HAS LESS ARMOR PROTECTION, AND DOES NOT POSSESS THE TOW OR 25MM CANNON CAPABILITIES OF THE BRADLEY.

THERE ARE THOSE WITH ME TODAY WHO CAN POINT OUT TO THE COMMITTEE THAT THE BRADLEY PROVIDES A LEVEL OF PROTECTION THAT WAS ORIGINALLY DEFINED, AS WELL AS DISCUSS IN DETAIL THE EXTENSIVE TESTS PROGRAM. THEY CAN ALSO SUGGEST ADDITIONS TO THE VEHICLE TO FURTHER ENHANCE ITS SURVIVABILITY.

IN SUMMARY, THE BRADLEY REMAINS A MAJOR COMPONENT OF THE ARMY'S COMBINED ARMS TEAM. OUR DOCTRINE IS SOUND, AND TESTING DEMONSTRATES THAT THE BRADLEY PROVIDES SIGNIFICANT IMPROVEMENT IN AGILITY, FIREPOWER AND SURVIVABILITY OVER ITS PREDECESSOR, THE M113. THERE IS NOT A VEHICLE AVAILABLE TODAY, OR IN DESIGN, WHICH COULD REPLACE THE BRADLEY. CONSEQUENTLY, WE BELIEVE IT IS ESSENTIAL TO OUR FORWARD CONVENTIONAL DEFENSE TO CONTINUE FIELDING THE BRADLEY AT A RATE OF ONE BATTALION PER MONTH.

WE KNOW YOU AGREE THAT OUR SOLDIERS DESERVE THE VERY BEST EQUIPMENT WE CAN PROVIDE. WE BELIEVE THAT THE BRADLEY, WITH THE PRODUCT IMPROVEMENTS RESULTING FROM THE ONGOING TESTING, PROVIDES THE BEST VEHICLE THE INFANTRY NEEDS FOR OUR COMBINED ARMS TEAM.

LETHALITY OF MAJOR CALIBER ANTI-ARMOR MUNITIONS AGAINST FIRST LINE ARMORED VEHICLES. THE ARMORED VEHICLES OF INTEREST INCLUDE THE T-62, M-60A3, AND M-1 TANKS; THE M-2 (OR M-3) AND BMP FIGHTING VEHICLES; AND THE USMC LIGHT ARMORED VEHICLE. IN ADDITION, THIS PHASE OF THE JOINT TEST WILL INCLUDE A REVIEW OF ARMORED VEHICLE DAMAGE ASSESSMENTS AND EVALUATION CRITERIA BASED ON A SERIES OF FUNCTIONAL TESTS.

THE M-3, BRADLEY FIGHTING VEHICLE WAS SELECTED AS THE FIRST ARMORED VEHICLE CANDIDATE. A TWO PHASE TEST PLAN WAS PREPARED AND FIRING BEGAN IN MARCH 1985 AND CONTINUED INTO OCTOBER 1985. A TOTAL OF 68 ROUNDS WERE FIRED DURING THIS PHASE, 10 OF WHICH WERE FIRED INTO THE BRADLEY WITH ITS FULL LOAD OF AMMUNITION, FUEL AND HYDRAULIC FLUIDS. SHOT SELECTION DURING THIS PHASE WAS MADE TO RESOLVE VULNERABILITY UNCERTAINTIES AND NO ATTEMPT WAS MADE TO DELIBERATELY DESTROY THE VEHICLE. RESULTS OF THESE FIRINGS WERE REPORTED TO CONGRESS IN DECEMBER 1985. ANALYSIS OF THESE TESTS DATA PROVIDED THE FOLLOWING:

AMMUNITION STORED IN TROOP COMPARTMENTS IS THE GREATEST CAUSE OF CASUALTIES.

SPALL FRAGMENTS ARE THE GREATEST CASUALTY PRODUCERS WHEN STORED AMMUNITION IS NOT HIT.

AUTOMATIC FIRE SUPPRESSION SYSTEM IS EFFECTIVE AGAINST FUEL FIRES BUT HAS A HIGH FALSE ALARM RATE.

CASUALTIES CAN MOST LIKELY BE REDUCED BY STOWING FUEL AND AMMUNITION EXTERNALLY.

THERE WERE SOME ISSUES THAT WERE UNRESOLVED DURING PHASE I THAT HAVE BEEN INCORPORATED INTO THE PHASE II TEST PLAN. THESE INCLUDE:

HEALTH HAZARDS POSED BY GASES WHEN VEHICLE IS HIT.

THE EFFECTS OF HALON ON THE CREW WHEN DISCHARGED INTO THE CREW COMPARTMENT.

THE EFFECTS OF THE BY-PRODUCTS OF HALON REACTION WITH FUEL FIRES.

CASUALTIES WHICH MAY OCCUR AS A RESULT OF OVERPRESSURES.

PHASE II OF THE BRADLEY LIVE FIRE TEST BEGAN IN MARCH 1986. THE PURPOSE WAS TO EXAMINE THE SURVIVABILITY IMPROVEMENTS THAT HAVE BEEN MADE AS A RESULT OF WHAT WE LEARNED IN PHASE I TESTING. THE ARMY TEST PLAN REQUIRED A REPEAT OF ALL SHOTS FROM THE PHASE I TESTS AGAINST A FULLY LOADED VEHICLE WHERE THERE HAD BEEN CONFIGURATION CHANGES ALONG THE SHOT LINE. ADDITIONAL SHOTS WERE ADDED TO EXAMINE THE EFFECTIVENESS OF THE REACTIVE ARMOR AND TO SATISFY GAO CONCERNS ABOUT SIMULATING THE MORE MODERN ANTI-ARMOR WEAPONS. IN ADDITION TO THE FULL-UP VEHICLE FIRINGS, OTHER BALLISTIC HULL AND TURRET AND COMPONENT LEVEL FIRINGS WERE CONDUCTED TO EVALUATE OTHER AMMUNITION STORAGE CONFIGURATIONS.

THE FOLLOWING CHANGES WERE MADE TO THE BRADLEY PRIOR TO PHASE II TO ENHANCE ITS ABILITY TO SURVIVE ON THE BATTLEFIELD AND TO REDUCE CASUALTIES:

EXPLOSIVE, "REACTIVE" ARMOR (TWO DESIGNS, BRL AND RAFAEL)
ADDITIONAL REGULAR STEEL AND ALUMINUM ARMOR
PARTIAL SPALL SUPPRESSION LINERS
REVISED FUEL SYSTEM
RELOCATION OF SOME 25MM AMMO, INCLUDING EXTERNAL STOWAGE
EXTERNAL STOWAGE OF MINES, GRENADES, FLARES.

AFTER FIRING 11 SHOTS, WE TEMPORARILY HALTED THE TESTS TO MAKE IMPROVEMENTS IN THE TEST PLAN AND TO SETTLE SOME UNRESOLVED ISSUES. TESTING IS SCHEDULED TO RECOMMENCE ON 2 JUNE 1986 AND

TO CONTINUE INTO OCTOBER 1986. THE PHASE II TEST REPORT WILL BE SUBMITTED TO CONGRESS IN DECEMBER 1986.

THE ARMY ALSO IS COMMITTED TO TESTING WHAT HAS COME TO BE KNOWN AS THE "MINIMUM CASUALTY VEHICLE," A CONFIGURATION WHICH STOWS FUEL AND AMMUNITION EXTERNALLY, OR IN EXTERNALLY VENTED COMPARTMENTS. INITIALLY, THE ARMY HAD PLANNED TO HAVE THE VEHICLE READY FOR TESTING THIS FALL BUT FOUND THAT MAJOR ENGINEERING CHANGES WERE NEEDED TO STOW THE AMMUNITION AND FUEL EXTERNALLY. THEY ALSO DISCOVERED SOME POTENTIAL PROBLEMS WITH THE INTENDED DESIGN THAT MAY UNNECESSARILY EXPOSE TROOPS TO OVERHEAD FIRE. THE ARMY IS FORMING A SPECIAL STUDY GROUP TO DETERMINE WHAT THE DESIGN CONCEPT SHOULD BE. RESULTS OF THIS STUDY SHOULD BE AVAILABLE IN DECEMBER 1986. I AGREE THAT THE ARMY SHOULD PROCEED DELIBERATELY WITH THE MINIMUM CASUALTY VEHICLE DESIGN SO THAT AN ACCEPTABLE RESULT IS ACHIEVED. WHILE A HASTY ACCELERATION WOULD BE UNWISE, THE ARMY ALSO SHOULD PROCEED TO GET THE JOB DONE AS SOON AS POSSIBLE.

ALTHOUGH WE HAVE EXPERIENCED DELAYS IN THE BRADLEY TESTS WE FEEL THAT THEY WERE NECESSARY TO ASSIST US IN IDENTIFYING THOSE CHANGES THAT ARE NEEDED TO ENHANCE THE VEHICLE'S SURVIVABILITY ON THE BATTLEFIELD AND TO MINIMIZE CASUALTIES.

Mr. STRATTON. Thank you, Mr. Secretary.

As I understand it, 3,000 Bradleys have already been produced. Is that correct?

Secretary MARSH. That is correct, Mr. Chairman. There are 3,000. The original contemplated buy is 6,882, I think, in 1985 that we would like to have and need. We would like to introduce them into the inventory at the rate of roughly a battalion a month, which you're talking slightly in excess of 50 vehicles a month.

Mr. STRATTON. And those 3,000 you say were tested. Is that right?

Secretary MARSH. The tests that I am referring to, Mr. Chairman, are the tests that were conducted in 1978 in the research and development phase, which related to the design and engineering of the vehicle. Those vehicles that are now in the inventory met the design specifications that were a part of those tests.

Mr. STRATTON. Who was it that conducted those tests, did you say?

Mr. AMBROSE. They were conducted by the contractor, FMC, and the—Tank Automotive Command—TACOM is part of the Army. They included in addition what is called initial production tests, which were carried out during the period 1981 to 1982 as the production started.

Mr. STRATTON. In other words, the producer obviously is not going to do anything that is going to indicate that the vehicle is not adequate. This is something that I hadn't heard about. We are concerned about the fight between the Office of the Secretary of Defense and the Army as to exactly what testing should be done, and the argument that has brought these vehicles into the national attention and, as a result of complaints of Members of Congress, the testing has not been adequate.

What is it that the Army wants to prove in the testing? Obviously the Bradley is not a tank. It can't withstand the same things that the tank can withstand.

My understanding, Mr. Secretary, is that there are two types of tests. Our staff spent a week down there in Aberdeen. There are two types of tests. One type is, as I understand it, you take it on on a modular basis to see whether you can knock off a track or where you can put some holes in, and the other type of test is a test of just what can the vehicle stand in the middle of the battlefield—in other words, how much does it take to finish it off? There seems to be a difference of opinion as to exactly how that result is to be arrived at.

My understanding is that Colonel Burton, who is the big hero in this undertaking, felt that the Bradley, when it really got a heavy shot, it was finished; and not only that, but because of the nature of aluminum when it vaporizes, it could wipe out the entire crew simply as the same result that the Exocets fired in the Falkland Islands battle were also extremely damaging.

What is it that the Army wants to prove?

Dr. HICKS. Mr. Chairman. the testing——

Mr. STRATTON. And I don't want Mr. Hicks to get into this, because this is the whole problem. The OSD wouldn't indicate exactly what their tests were that they wanted with the DIVAD, in spite of the fact that Mrs. Byron was after them for weeks last year, and

we still never got any answer. So what we want to do first of all is to find out what kinds of tests the Army wants to supply and what are they going to prove.

Secretary MARSH. Mr. Chairman, the tests were mandated by the Congress in two phases, to be done in concert and cooperation with OSD. The Army, with Mr. Ambrose, worked with Dr. Hicks in structuring both phases of those tests. Phase 1 has been completed. They are now approaching phase 2, and I think they can probably respond to the question that you asked.

Dr. HICKS. Mr. Chairman, maybe I could start.

Mr. STRATTON. Well, I don't think this is in line with what we want. We don't want OSD telling us what you are supposed to do when you haven't even made any statements of what was required by the testing, how the tests were to be carried out. Isn't that the case?

Secretary MARSH. They had to be done with the approval of OSD, Mr. Chairman, which is the reason I defer to them.

Mr. STRATTON. Pardon me?

Secretary MARSH. OSD had to approve the tests, sir, for us to do them.

Mr. STRATTON. Yes. Would you, Mr. Ambrose? What were the tests that you said were required by the vehicle?

Mr. AMBROSE. The testing that you are referring to is the recent testing, the so-called phase 1 and phase 2, so let me address that directly. The purpose of any of that testing, and I think that is agreed all around——

Mr. STRATTON. Do you want to speak up a little more? I know you may not want the people to hear, but we would like to hear it up here, anyway.

Mr. AMBROSE. Oh, no. I'm a world class mumbler. I'm sorry about that.

The tests, and I think that it was agreed all around, were intended to determine more facts about the vulnerability of the vehicle to various kinds of incident ammunition, and missiles. What was not agreed to was exactly which missile should be tested when, in what order, and details of that sort. But I don't believe there is any disagreement that the purpose of those tests has been and continues to be to learn what we can in respect to the vulnerability, over and above the already demonstrated performance to specifications that was shown by the earlier tests that I referred to. Incidentally, I think I should say, the tests were conducted at places like Aberdeen Proving Ground and other Government facilities, under the watchful eye not only of the procuring agency but the test command and the Office of Test and Evaluation that reports directly to the Chief of Staff. I don't want to leave any impression that those tests were in some sense invalid because they were in the hands of the developer. The hands of the developer were watched very carefully, and no question that I am aware of has been raised as to the validity of the earlier tests.

The difference of opinion that has led to the kinds of discussions we are having here has been whether the tests should be concentrated on learning as much as possible about the validity of the models—the computational models and other analyses that we used to ascertain whether we have met the vulnerability require-

ments—or we should just pepper the vehicle at random—so-called at random—in order to get some kind of an overall result which could then possibly be labeled "vulnerability under combat conditions." That latter is the viewpoint, I believe, held by Colonel Burton and people of that persuasion.

Our view about that was that it was not a process that would lead to a conclusion of any statistical validity; that there simply weren't enough shots, there aren't enough vehicles; that most of the proposed shots would simply blow up the vehicle, which we acknowledge would in fact happen in these overmatched conditions. Therefore, what we proposed and what was agreed to by OSD—and Dr. Hicks can speak to that—in the first phase was a series of deliberately planned, aimed shots designed to improve our instrumented insight into what happened when the shots went along certain lines of fire.

What is to be done next in phase 2 testing primarily is to take a vehicle that has been modified by using the results of the first phase test to see if the modifications in fact result in substantial or significant or insignificant improvement, verifying the earlier results. Therefore, much of the testing in the second phase, which will be conducted starting shortly, will be testing of a verification kind. Some of it will be increased intensity of shooting. We can give you any details you may wish. That test plan will be agreed to and supplied to the Congress, your committee, by no later than the date that you have specified. Dr. Hicks and I will personally see to it that there is such information, and that there is such agreement.

I think perhaps if that is sufficient comment for the moment on the purpose of the testing, it might be appropriate to have Dr. Hicks comment on——

Mr. STRATTON. What was the argument that Colonel Burton had?

Secretary MARSH. Colonel Burton said that you can't determine the vulnerability of the vehicle under combat stress by the pattern of shooting that you are proposing because it is not a random pattern. It is, in effect, a loaded pattern that you have deliberately devised, and he has I believe accused us of devising it in such a way that it conceals or reduces the vulnerability, which is simply not so. The number of shots that are available would not constitute an adequate demonstration of Colonel Burton's thesis if we did it exactly his way. There simply are not enough shots and there are not enough Bradleys. It is a waste of the taxpayers' money to simply blow up a large number of these vehicles in order to prove that they will blow up if they are hit by tank rounds or TOW missiles. We know that if those missiles hit the ammunition inside this vehicle, it will destroy the vehicle. We simply don't need to keep throwing $2 million or $3 million per vehicle away over and over to make that point.

Mr. STRATTON. Mr. Mavroules.

Mr. MAVROULES. Thank you very much, Mr. Chairman. I want to go along with part of the questioning.

First, let me commend all of you for the total, overall modernization that has been taking place during the last 4 or 5 or 6 years. But you have to put yourselves in our position, and I hope you will do that for just about 30 seconds.

It was last year about this time or a little bit before this time when we had members from the Army, Mr. Secretary, and many of the generals who came before us were talking about the DIVAD. You recall the DIVAD. They gave to us information that the DIVAD was working; it was a good piece of equipment; it was going to work. If you go back in testimony, you will find that.

Then suddenly one morning all of us awakened, including the chairman and the entire membership of this committee, and we found the Secretary of Defense on television cancelling out the DIVAD contract. In the meantime we were under the impression that things were going pretty good, and that tests were going to work, and it would be a good piece of equipment.

OK, that is in the past. I want to forget that. That is behind us. Are we headed here now in the same direction as we were with the DIVAD? What kind of guarantees can you give this committee and, by the way, give to the public this morning, where the integrity of the tests have been challenged by others—and it is a mere fact that that is the case—that this vehicle is going to be all that you state it is going to be, and that you guarantee the tests will be those that are going to determine in which direction we go? Are we going to awaken some morning again and have Mr. Cap Weinberger go to the press and say, "Well, it's a bad program. We're going to cancel it." Would you respond to that, please? We have had one bad experience and we don't want to get rolled again, Mr. Secretary.

Secretary MARSH. Let me try to distinguish between the two questions. I would say to you that the fate of what happens to the Bradley is more in the congressional hands than it is in the Department of Defense.

Second, the DIVAD was a weapons system that had not yet reached or qualified under its specified design criteria. The Bradley has met its design specifications. It met those, I would say, sometime in 1978 to 1980 if I'm not mistaken.

Mr. AMBROSE. Yes.

Secretary MARSH. What is occurring now is placing the Bradley through a series of tests that are over and beyond the design tests for which the vehicle was ever built. You are placing it into open fields of fire that I can tell you heavy armor is not going to acquit itself well, and no armored personnel carrier—Bradley, Russian, German, any of them—can stand those kinds of overmatching fires.

We do know and have learned from the tests that have been conducted, that there are some areas of survivability in which the Bradley actually is doing well above anything that was anticipated. We also know from those tests that by certain enhancements, we will be able to further develop its survivability—for example, the installation of spall liners and the use of reactive armor are modifications that will upgrade it.

Some of the tests to which the vehicle has been subjected are for fires of weapons systems for which it was never designed, in its criteria, to be able to stand and survive. Questions have been raised now about using more advanced Soviet weapons against it. It was never designed to provide total survivability to those systems.

Therefore, if you are looking for a vehicle that has met its design criteria, it has done that. If you are looking for a vehicle that is totally invulnerable on the battlefield, there is not one in our inventory or any inventory of any army of the world.

General WICKHAM. Can I add something to that, Mr. Mavroules? What the testing will enable us to do, even though it will be against overmatching weapons like the TOW or the Soviet equivalent—and we are doing that in phase 2, trying to get to the future weapons—what it will tell us is what we might do to minimize vulnerability. Because if a jet from an overmatching weapon goes through the armor, by restowage of munitions inside, maybe a spall liner, maybe reactive armor on the outside, we might avoid the catastrophic loss. We might be able to survive with the vehicle, and the testing will enable us to determine what can be done.

However, the Secretary's point is well taken. No troop leader in his right mind is going to deliberately put any armored vehicle into a situation which will make it susceptible to fire from overmatching weapons, no more than dismounted infantry will go right up a hill in the face of overmatching fire when they can use cover and concealment and maneuver to go at it from the flank. That is exactly how we intend to use these vehicles.

Mr. MAVROULES. General, I understand that. I understand where you are coming from and I think you are right. You are correct. I am not arguing with you. Congress has not been accused of perhaps misguided tests, by the way. You have been accused—the Army—and therefore you have a responsibility not only to the Congress, but you also have one to the American people, and you have that shot this morning with the press here. It is an open meeting. We want the tests that are supposed to be taking place. We want to be able to confront any allegations out in the open, that we are doing things right, we are getting a piece of equipment which is going to do the job. I think that is your job, to convince the American people and also this committee—by the way, a committee that has been so supportive of your efforts.

That is the only thing I have to say. I don't want to get into the technical part. That is your job.

Secretary MARSH. We do appreciate that support, Congressman. There are many, many people that are making suggestions about how this vehicle should be tested, from many different sources. This is one reason that General Wickham and I both suspended the second phase of testing, until we can get some consensus of agreement on adequate tests that will satisfy people who have questions about it. In the long run, we believe having asked those questions now will have a very helpful result and lead to a better, more invulnerable vehicle. This is one of the things that both Dr. Hicks and Mr. Ambrose have been trying to do, to be certain that anybody that looks at those tests on phase 2 will say they are fair, they are more than adequate, and they meet the requirements that Congress has asked us to meet.

Mr. AMBROSE. If I can comment, Congressman, to the integrity part of this issue, I don't think anyone at this table would support for an instant anything that was improper, conspiratorial, malevolent or that sort of thing. When this issue built to the level that it did some months ago, as the Secretary said, they stopped the testing, and asked the Vice Chief of Staff of the Army and me to get into it and determine for ourselves whether there was anything to such charges. We have had the General Accounting office—GAO—look into this and they have issued a report. Dr. Hicks, who can

speak for himself, has concerned himself with this question. We do not find anything whatever that supports the charge of lack of integrity of these tests. We do find specific quarrels going on as to the kind of testing and the way of interpreting it, but all that has been spread out on the record, too, so that any fair—or unfair, for that matter—person can read the stuff for himself. There is nothing about these tests that has not been disclosed and that is not available, and there is nothing improper or lacking in integrity.

It is a difficult, complex subject, though, and explaining the complexities is a problem that we have in a continuing way, but I assure you that we are solidly of the viewpoint that there is nothing whatever that supports these charges of lack of integrity. We can go into the specifications and the details of the testing in any way that you want, of course.

Mr. STRATTON. Dr. Hicks, do you subscribe to the objective of the tests that Secretary Ambrose has enunciated earlier and just now has enunciated?

Dr. HICKS. Absolutely. Let me go back and repeat something the Secretary said. I think there is confusion here. You started at some point in time with a military requirement and designed a vehicle to meet that requirement, and the vehicle met that requirement very satisfactorily.

As we have also said, everything is vulnerable, so that you can always design a test and do something to kill it. Sometimes some of the people involved in testing do something like saying, "I am going to see if a .45 caliber fired into the heart of a soldier will kill him." You know, I don't have to do that to know that probably is a result of it hitting. It has nothing to do with what we know is going on on the battlefield. What we are going to do is to have an operational vehicle that will give us a degree of protection and a decided edge on the battlefield. There are certainly going to be some casualties.

If you have been in the infantry, which I have been, you know that to have protection like the Bradley is an incredibly helpful thing. I mean in comparison to being exposed as an infantryman to, for example, artillery airbursts where you are subject to shrapnel from the sky, the Bradley is a significant help. It did well before we ever talked about this issue.

Now I have a statement that I am going to put in the record. I don't want to read it because it is long, but there are a few points that I would like to make about it which have to do with what happens next. You have a vehicle designed to meet a military specification and now at some point in time you would like to see, as new hardware is developed and fielded by the enemy, just how well you are doing.

Therefore, we have decided to institute what we call the joint live-fire test program. The objectives of that program are to gather the empirical data on vulnerability of the United States systems to the Soviet weapons and the lethality of our weapons against the Soviet targets. We also want to provide insight into design changes that are necessary to reduce those vulnerabilities of our systems and to improve the lethality of our weapons against his system. This is a continual situation the Department of Defense has to be concerned with. Then, based on this data base, we want

that available for us for battle damage assessment, to tell us if we need more vehicles, more people, how we do it, and to repair the vehicles.

Now the Bradley Fighting Vehicle was actually selected as the first of our armored vehicles as a candidate for the joint live-fire test program. A two-phase test plan was prepared, and the firing began in March 1985, and it continued into October of last year. The results of those firings were reported to Congress in December 1985, and I would like to say something about those tests.

I had the responsibility—and I had been in the building about 6 months then—to carefully review the tests and to give Congress an OSD test report. We had a very close working relationship with the Army. Colonel Burton was, in fact, the lead person in my shop who has been working with the Army since 1984 to get these tests together. I saw the Army test report. I went over it carefully with many of the people in my test organization. I went over it carefully with Colonel Burton.

I then later heard about a Burton report. Now it isn't our job to write a report, per se, in DOD and OSD. It is our job to provide oversight. We have oversight to make sure that the people who are doing the tests are doing it properly, and that the information that is being transmitted to both the Secretary and to Congress is accurate. That is the job of the people who work for me.

Now there had been a test report written by Colonel Burton. I had no problem with that, but it wasn't necessary. It was immediately given a lot of publicity, but I had gone through that test report with Burton very carefully and compared it to the Army report and asked questions—and I might add that I will bring people over who were in the room when I asked the questions and who will, under oath, testify to what I say.

I asked Colonel Burton specifically if there was anything in the Army test report, which I had carefully analyzed myself, that he had any disagreement with. He said, "Well, not really." I said, "No, I want to know exactly." He said, "Well, a couple of places, minor situations like, for example, the number of people that they used in one of their test vehicles. If they had had more people, which was a different version of the Bradley, there would have been more casualties." I mean, it is a simple multiplication factor. It has nothing to do with the test results.

As far as I am concerned—and I certified to that to the Secretary and he sent the report over—the Army report became the OSD report after careful analysis, because we provide oversight. We had been working with the Army to make changes in that report earlier, and that was a good report that specified exactly what we found wrong—not to say "wrong," what we found more vulnerable—during those live-fire tests that we conducted on the Bradley which already met its manufacturing specifications.

Since the world moves on and the enemy improves its capability, you have to be continually doing things to improve your product. Those live-fire tests are designed to improve the product. We knew at the end of the test report that we sent to Congress that there were improvements that were available to us that were reasonable in expense—because that is also an issue when faced with priorities—that we could do to the Bradley to make it less vulnerable

and to protect the individuals inside better. That included the possibility of adding reactive armor; of putting things inside, spall liners, to prevent some of the fatalities due to spall; perhaps moving things from the center of the Bradley more to the rear.

Now those things you think you can do have to be tested again. That is what phase 2 is all about, but I wanted to point out something very important which I totally agree with Mr. Ambrose. It is very important to get engineering data for this kind of an analysis. If you take a Bradley out in the field and you say that the Russian soldier is aiming at the center of that Bradley, which he will do, you can't be sure where that round is going to hit.

I can give you situations in battle where we have moved the ammunition from the center of the Bradley to the rear and low, to avoid that being directly hit to cause an interior explosion, and I will in fact have moved it into the place where it gets hit by a round and does explode, where if it had been in the center it wouldn't have been, so those are the kinds of intangibles of battle where you must gather an enormous amount of statistics. You can't get enough statistics, as Mr. Ambrose said, by having just a continual ad hoc view of firing rounds to see what happens.

I believe the Army has done an excellent job. There are some unresolved issues in phase 1 that have to be resolved. Phase 2 of the Bradley live-fire test began in March of 1986, and the purpose was to examine the survivability improvements that resulted from the things they did. There were, as Mr. Ambrose said, temporary stops in this to make sure that we were really doing everything right. We had a basic test plan. We didn't have some of the details that we would have liked to have at OSD, but we had already concurred on a general test plan for the Army.

We are in the process today of hopefully finishing up all the details so that we will have exact agreement between OSD and the Army on those tests. By the way, those tests we should start about the 2nd of June, and they will continue into October of this year. A phase 2 test report will be submitted to Congress by the Secretary in December of 1986. Those delays in the Bradley tests were necessary to assist us in identifying the changes that we felt that we needed to enhance the vehicle's survivability on the battlefield and to minimize casualties.

Mr. STRATTON. On the basis of that, I would gather that you pretty much support the position of the Army on these tests.

Dr. HICKS. I absolutely do, yes.

Mr. STRATTON. And not the remarks of Colonel Burton.

Mr. AMBROSE. Mr. Chairman, could I underline one point there because I think it illustrates a problem we all have—Congress, the taxpayers, the Defense Department. The game does move on, and it isn't a game, it is deadly serious. However, this reactive armor, which now appears to be a useful thing to add to the Bradley, did not exist anywhere in the world in service when the Bradley even went into production. That is a very recent augmentation.

Three, four, five years from now we may well see some other improvement that doesn't exist today, and I think we will be faced with the necessity of once again examining what to do about it, not just with Bradleys but with tanks and with all of our armaments. If we say, "Stop, throw this one away," because one of these new

influences has appeared, and start over again, I think we will get ourselves on a treadmill, a very, very costly treadmill, and I don't think we will have anything on the battlefield that remotely resembles what should be there.

We are constantly product improving and we are trying to do it wherever it is prudent rather than bringing new systems into effect. I think this reactive armor is a clear illustration of that sort of influence that we have to put up with. We do not control the whole of that game. The Russians control it.

Secretary MARSH. Mr. Chairman—pardon me.

Mrs. BYRON. Mr. Chairman, we have a vote over on the floor. I have a couple of questions that I would like to ask, if Mr. Ambrose will give me the privilege of asking a couple of questions before we go vote, in our timeframe.

Mr. STRATTON. Yes, by all means.

Mrs. BYRON. Let me touch on a couple of points. I think the thing that concerns me and I think concerns the rest of this committee, we have a responsibility to mark up a procurement bill. We have to go to the floor with that bill. We have to defend it on the floor, and all we are asking from you is to be able to come before us and say, "The test program is going along," or "The test program is not going along," or "The tests are doing well," or "The tests aren't doing well." We have to have something to be able to go to the floor with.

You know, I keep trying to not see a parallel in the DIVAD program with the Bradley. I really do. However, I keep seeing parallels come up. In December 1984 we needed test results from DIVAD to be able to go to the floor with the DIVAD. In December 1984 the guidelines weren't even written for the tests that we needed the results on in March. There is no way that we can operate that way.

It is very, very difficult for me to understand that the test phase 2 has been designed, has been done, but OSD hasn't yet approved of it. You say you hope you will have it approved soon. You hope to have the tests started in June. We are now in May. We have to mark. You know, I find it very difficult to understand that a program such as the Bradley, which was tested in 1978, we have procured over 3,000 vehicles out of a total buy of 6,882, and now I have constituents and I keep picking up the paper and the news media is saying, "This Bradley vehicle really doesn't work."

Well, the Bradley vehicle does work. Our guidelines for what it was procured—it was designed for—are there. Are we changing in midstream the guidelines of what we are looking for? The issue of the water cans, just for example, in the testing phase the water cans were placed in one place and they were changed before phase 2. Why were they changed? Were they changed as a modification? Were they changed because of the tests? These are the kinds of questions that I am asked out on the street, and I was hoping today that you would come before us and say, "These are the criteria we have. These are the guidelines we are using. This is where we are going with the test program."

During the full committee posture hearing with the Army I listed, I think, 11 programs that had been terminated since 1981. I asked then how and why and what can we do for the credibility of the acquisition program and process to be restored? How can we

get the credibility—and we have to go to the floor with restored confidence in the system—when we consistently run into these problems?

Mr. AMBROSE. Shall we save the answers until you come back?

Mr. STRATTON. Yes. I think if you could work on the answers——

Mrs. BYRON. That will give you enough to keep you busy while we're gone for about 10 minutes.

Mr. AMBROSE. Mrs. Byron, if I can just say one quick thing, the tests are going on and they are going well, and the information is very useful. We will come back to it in more detail.

Mr. STRATTON. The subcommittee will stand in recess.

[Recess taken.]

Mr. STRATTON. The subcommittee will come to order.

The original statement that I made in opening the hearings says, on page 2, that "We require that the Department of Defense report to this subcommittee not later than June 6, 1986, with an OSD-approved detailed test plan for the Bradley phase 2 live-fire tests, and we would expect that the testing will not resume until that approved test plan exists." That is substantially the same thing that Mrs. Byron was asking. I think you indicated that you would have it by June 2. If that is fine, that is even better. I think, however, Ms. Slatkin points out that you make it sound as though everything was peaches and cream and hunky-dory but there are, as I understand it, some other areas of concern that have not yet been mentioned. Perhaps, Ms. Slatkin, you might point out those to the witnesses.

Mrs. BYRON. Mr. Chairman, I had asked sort of a series of questions, and it was my understanding that when we returned, we were going to get the answers to the questions that I had asked.

Mr. STRATTON. I thought this was the same thing that you asked, that there would be on June 6 a detailed test plan approved by the OSD.

Mrs. BYRON. Well, I—go ahead.

Mr. STRATTON. If that is not it, did you have some additional points?

Mrs. BYRON. Yes; I had some additional points. My question was fairly lengthy and I think everyone remembers what the question was, so I was just really trying to get some answers.

You know, I find it interesting that this morning we have the Secretary of the Army, we have the Chief of Staff of the Army, we have the Under Secretary of the Army, we have the Under Secretary for Research and Engineering of DOD, who have all come before us this morning to tell us that the Bradley program is fine, it is doing very well, and that test phase 2 is about to begin and there are no problems. If there are no problems, we certainly do have an awful lot of top people over here to come tell us that we have no problems.

The thing that worries me is that the process that we have has some problems. The Packard Commission has come up with some proposals and some guidelines in our process, and I think that has to be an outgrowth of areas where we had problems. We are seeing a program such as this one—and I can go down to specifics, and let's go back a little bit to specifics, and that is the test program—I understand fully that things have changed since the original concept of the Bradley fighting vehicle in 1978. I understand that the

weapons that are going to be used against it have changed. I understand all of that. What I don't understand is how a program such as this one, when we are into 3,000 vehicles already procured of a potential 6,800 buy, why we are having these problems and why it has picked up such a high profile as a wounded program. Those are the things that worry me.

Mr. AMBROSE. I am not sure you should be asking those questions of us. We——

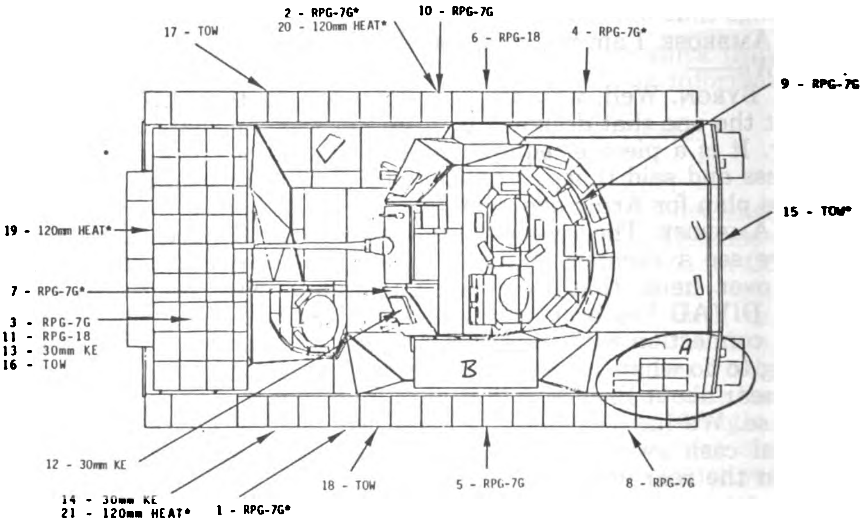
Mrs. BYRON. Well, who am I supposed to ask them of? I mean, I am not the one that designed it. I am not the one that is doing the testing. It is a piece of equipment that you have come before this Congress and said that is vital to your plan, your overall, comprehensive plan for Army deployment.

Mr. AMBROSE. The reason I said what I did, Congresswoman, is that we see a number of things raised in the public press and I think over here, that we don't understand why they are even raised. DIVAD has been mentioned. We heard a lot about latrine fans in connection with the DIVAD. It just took a currency that had nothing to do whatever with the facts of the matter.

We hear about Bradleys, that aluminum burns. That is technical nonsense. We have said so over and over. I have offered to pay a personal cash award to anyone who can get aluminum sheets to burn on the rear entrance to the Pentagon. I don't know how you stop that sort of thing. What burns in these vehicles is fuel or ammunition or minor parts of combustible materials, not aluminum, and that same fuel burns in a steel vehicle. I don't know how you stop that sort of thing.

We hear about this water can business. Maybe, Mr. Chairman, if I could just attempt to put this water can business down, for one thing, we can get back to the central business of the test plan.

# HIGH SURVIVABILITY BRADLEY FIRING SEQUENCE




* Repeat of Full-up Baseline Shot

I think you have in front of you a little, rough diagram that I gathered up here. It looks like this. Have these been put in front of you? Well, it is on its way up there. The first point I make about this water can business is that there are two 5-gallon jerrycans. They amount to about 3 percent of the presented area, so in the first approximation it doesn't matter where you put them or what you do with them or whether you have them there at all, as to its impact on the overall vulnerability of this vehicle.

Second, in the original arrangement, which is the opposite of the diagram you have here, some stored ammunition was in the middle of the vehicle, item "B," in the phase 1 tests. At the end of phase 1 tests we all said—including OSD as well as ourselves in the Army—we all said, "Let's see what we can do to rearrange things within the vehicle so as to reduce the vulnerability to some extent, and then we'll test it again and see what happens."

Therefore, we took the water cans and put them in the place shown on the diagram, and we took the ammunition that was stored there and put it over where it is shown in the diagram under "A." Now that was supposed to have been done by FMC out on the west coast before they delivered the modified vehicle to Aberdeen. When the vehicle got to Aberdeen, the testers noticed it hadn't been done and simply said, "We told you to put the stuff the other way. Now do it."

It was done before any shot was fired. It is recorded. The shots were fired. It was noticed. It was labeled, by those who now want

to make a big fuss about it, as an insignificant thing. It wasn't until quite a bit later that it was puffed up to a significant thing. I assert—Dr. Hicks can speak for himself—that it is an insignificant thing in fact and in absolute effect, but what was done was exactly what was intended to be done as part of the subsequent test series.

Mrs. BYRON. Well, Mr. Ambrose——

Mr. AMBROSE. I don't know how you stop the latrine fans and the burning aluminum departments. They are not us. We do the best we can.

Mrs. BYRON [continuing]. I agree with you on that because that was one of the arguments that I had on DIVAD, talking to people in the field in charge of the test. I said, "Look, I know it doesn't hit the latrine fan, you know it doesn't hit that, but I have 430 other colleagues that think it does, and what I am trying to do is to get some answers which I need from your test program, to be able to go back to the floor and say, "It doesn't hit it. This is what it does."

Now let me say that we have a report that is going to be issued tomorrow, and some of the things that are in that report are substantially different from what we are hearing today.

Mr. AMBROSE. Well, I hope you will raise the questions.

Mrs. BYRON. That is one of the reasons that I am very anxious to be able to counteract the questions that have been raised in my mind, because I feel very strongly that we need the modernization of our Army. We need the protection that the Bradley gives our infantrymen, and in a production when we are halfway through the production is not the time to turn around and start looking at a program and trying to eliminate a program.

Mr. AMBROSE. As Ms. Slatkin will surely agree with and support, the first person she met with in the Army was me. She came in with that group specifically to receive from me assurance that we intended to give them anything and everything they wanted, and we hoped that if they had any questions we would hear about them. I presume we will hear about them, since we haven't seen a report, and we will do our best to answer them.

Dr. HICKS. Mrs. Byron, may I make a general philosophical statement here?

Mrs. BYRON. Certainly.

Dr. HICKS. I have said this at different times, different ways. We are dealing with things, when we make tests of vehicles like this, when we make improvements on vehicles like this, that require expertise, require people who have spent time and part of their lives thinking and working with those things.

Clearly I would think that everybody would believe that the Army wants the best things for themselves. Now you might try to find places where the Army has done things that are not clever, that have been manipulative, through the past. If so, I say that is also due to the general feeling I have of the problem we have in this country. I mean, I think we are absolutely shooting ourselves in the foot, and the Soviet Union must be cheering daily at the kind of criticism, overmanagement, micromanagement, overwhelming kinds of management by people who have not spent their lives thinking about these situations, working with these problems, and trying to come up with the best solution.

Therefore, you see, we get into these arguments that you are talking about because people who don't understand them are getting so much detail that they really have a tough time understanding and handling it. Now you have to have some trust someplace for people that you put in administrative offices, and that is a problem.

Mrs. BYRON. I try. I try, but gosh, sometimes you make it difficult.

Dr. HICKS. Maybe, but on the other hand you make mistakes in industry all the time. If you make mistakes, then you take the responsibility, but we are spending so much of the Defense Department's effort and the industry's effort on oversight and people looking into minute details of why you move water cans. These are technical areas that people can argue about technically with different judgments. But to try to explain that to someone with a technical degree who happens to like to see his name in the press or wants to be patted on the head by somebody in authority, doesn't necessarily mean that somebody else is trying to hurt the country, make something wrong with the weapons systems that we all want desperately to be the best.

The Bradley is an important vehicle to the Army. You can make all of the statements you want to make about why it is wrong. You can always find things to complain about, but if you go down to the infantryman in the field and ask what he thinks about the Bradley, you will get the right answer: He wants the vehicle and needs the vehicle. Whether or not the ammunition or the water cans being changed back and forth has some incredible significance to Congress is really beyond me.

Mrs. BYRON. That is why I prefer to go to the field and find out how things operate.

Mr. AMBROSE. Mr. Chairman, have we addressed your question adequately on this June 6 business? We will try to get it here sooner, but Dr. Hicks and I are committed to making it. The agreement will be an honest, open, complete one, and we will not run the tests until we have done that thing and until we get it over here. If there are issues that you feel are not resolvable or we haven't addressed, we certainly wish to hear about them.

Mr. STRATTON. Mr. Dyson.

Mr. DYSON. I have a quick question just on that issue of the testing. It has never been really clear to me. I realize that the Army and OSD had a dispute about the testing. It is never really clear who stopped it at the Aberdeen Proving Ground. I think that the chairman has made a very good recommendation in trying to get some of this kind of testing schedule more ironed out and to get a plan, a detailed plan, before June 6.

My gut reaction in all of this is that even with that, I don't know that you can save this. In fact, my own feeling is that probably one of the best things is to probably not include it in the markup for the procurement this year, in the hopes that those tests that the Secretary refers to on the last page of his statement, that with the product improvements, ultimately the Army will provide the best vehicle the infantry needs for our combined arms team. I think that is the only way we are going to save it. It is in trouble.

I understand everything that you have just said about how the Soviets perceive these things, but perhaps more important than that is how our constituents perceive some of these things. I mean, they are the ones that ultimately pay the bill.

Dr. HICKS. I understand that, but this is to save the constituents' lives some day. The fact of the matter is that the Bradley Fighting Vehicle right now, if you didn't do anything to it, would be worth buying the next 3,000 vehicles. It is the best infantry fighting vehicle in the world. It is absolutely incredible that because of some uninformed engineering discussions that are basically a matter of opinion, that we malign a vehicle that is so important to this country.

I find that, as an American citizen—forget my position—incredible, that we have spent all that money on the Bradley, that we have purchased 3,000 vehicles the Army needs and wants, and that we now find ourselves in a position because of misinformation and grandstanding, that we might lose the next 3,000 vehicles. I mean, I just don't believe that is America.

Mr. DYSON. Let me say, you know, I am not grandstanding, and certainly I don't think anyone——

Dr. HICKS. Sir, I didn't say you were, but I am saying there certainly have been people who are.

Mr. DYSON [continuing]. Can question my commitment to national defense. I mean, you just look at the record. However, I know one thing: When I came here, when I was elected in 1980, there was a tremendous grassroots support for national defense, and I have watched that just whittle right away, even in my own district, which happens to be the Aberdeen Proving Grounds, where there is such tremendous skepticism about what is going on with these procurement practices. We are in real trouble out there.

Dr. HICKS. I know.

Mr. DYSON. We are in real trouble because we have lost some of the faith of the American people.

Dr. HICKS. I know and I am concerned about that, too.

Mr. DYSON. Now let me finish. What causes me some problem is the statement of Secretary Marsh where he says, "We believe the Bradley, with the product improvements resulting from the ongoing testing, will provide the best vehicle for our combined arms team." I think if my constituents would see that they might say, "Well, Roy, shouldn't you wait and see what happens?" I know I see you all shaking your heads, but I am just saying look at the perception of this.

Dr. HICKS. Yes.

Mr. DYSON. Should we perhaps wait before we go on with those continued buys, until we find out what those product improvements or that testing is going to show? At this point we don't even have a detailed plan on the schedule for the further testing. We are up the creek, Mr. Secretary, and I, like Mr. Mavroules, Mrs. Byron, and a lot of the others today, you know, a lot of us stuck by you all on DIVAD and then watched the Secretary of Defense pull the rug out from under us. I know, because I was driving on my way from the Eastern Shore to the Capitol one day and turned on National Public Radio and heard that happen. I was sitting there

saying, "My God, what's going on?" We don't want to be faced with the same kind of situation again.

Dr. HICKS. Mr. Dyson, nobody feels more distressed than I about the way that the country appears to have lost its apparent faith in the aerospace industry and the Defense Department to deliver goods and equipment. The fact of the matter is that we are still getting excellent equipment and the industry is still delivering good equipment. The expense of that has gone up, in my mind partly because of the incredible oversight and micromanagement that we have now imposed in that area.

Everybody is to blame. The industry is to blame because of its selfishness. Congress and the Department of Defense is certainly to blame because of its selfishness. I don't know how to say this except that, for example, on waste, fraud and abuse I guarantee you I will put the characteristics of waste, fraud and abuse in aerospace against those of the building industry any day. There are people who are crooked, and that is what has been eroding American support for defense. There are crooks everyplace, but if we had said, for example, that we would all join together to get the crooks—which we really should be doing—we might get someplace much faster.

However, the Bradley, which is the discussion for today, is as it sits, a tremendously important piece of equipment for the Army. We are trying to make it better, and we are going to have to come in to you some day and say that we want more money to fix the Bradley to make it more survivable and make it less lethal for the troops inside if it gets hit. But that vehicle is an important vehicle. When I think about World War II when I was an infantry second lieutenant and had to fight without that kind of a vehicle, and see what our soldiers must fight against today, they need the mobility and firepower of the Bradley because of the terribly increased firepower of our adversaries.

We in the Department of Defense support the Army and the vehicle. We support the Army's test program. We support the live-fire program. The kinds of discussions that we are talking about here are what I call technical disagreements between people of good faith. However, sometime, someplace, somebody in charge of the engineering department has to make a decision about which of the guys who are coming in with their views is right, because there is always disagreement in the technical areas about this and that. That is the way engineering is developed. Now we are making those decisions.

The reason the Army stopped the test is because, that while we agreed on the test procedures in a general way, there were so many complaints about details like water cans, the decision was made to get on top of that and to come in with a very, very detailed plan. That very, very detailed plan will be hopefully approved by us today, but certainly in plenty of time to meet Mr. Stratton's time requirement. We will not start the tests until that test plan is agreed to by Mr. Ambrose and myself.

Mr. AMBROSE. It would seem to me, Congressman Dyson, that we would be much more legitimately subject to criticism were we not to seek improvements in each and every thing that we do, than to

be flogged for making statements that with improvements we will have a better vehicle.

Mr. STRATTON. Mr. Skelton.

Mr. SKELTON. I would like to ask some questions. May we go back—and I believe we had better call on my friend, Mr. Ambrose, to at least answer some initial questions—let's go back to square one, may we, as to why we are here to begin with. The Bradley Fighting Vehicle, which as you know I have supported all along—authorized, appropriated, some 3,000 now in the field. Is that not correct? There was testing done at that time. What brought about the need for additional testing, Mr. Ambrose?

Mr. AMBROSE. The modifications. The world moved on, Congressman Skelton. The new weapons appeared. New armament types appeared—reactive armor, for example. Questions were raised about whether we had done the best arrangement of the fuel system, the electrical cables. The amount of test information was challenged, as to whether the experimental tests were adequate to verify the analytical assertions.

Mr. SKELTON. So was it determined by the Army, then, or OSD, or both, that there must be a phase 2 testing? Is that correct?

Mr. AMBROSE. Well, both OSD and the Army agreed upon the need for further testing.

Mr. SKELTON. When was this?

Mr. AMBROSE. I think originally the plan was under OSD direction to have a general joint live-firing program, and include in that the Bradley, and to use the Bradley as the first example, so it is a broader investigation over time and overall than just the Bradley. The Bradley test is the first of a number of such programs.

Mr. SKELTON. As I understand it, in following——

Mr. AMBROSE. That was in 1984.

Mr. SKELTON. In following the media reports on this, there was a sharp disagreement as to the manner in which the tests were conducted. Is that correct?

Mr. AMBROSE. Yes. The primary disagreement was over whether one should simply shoot randomly aimed shots or a deliberately chosen pattern to shed light on the results. As part of that disagreement, the one viewpoint which went with the random shots is first blow it up and then work down from there. The other was, work it up from the other end; take the ammunition out and the fuel out and learn, instrument fully, and then as you go——

Mr. SKELTON. Which was the OSD directive, to blow it up first or blow it up last?

Mr. AMBROSE. Just one member of Dr. Hicks' organization held and espoused that viewpoint. The approved plan was the Army-advocated plan.

Mr. SKELTON. Then did Dr. Hicks' department approve the Army tests?

Mr. AMBROSE. Yes.

Mr. SKELTON. However, there was a dissenter in his shop. Is that correct?

Mr. AMBROSE. Yes. I guess I can speak to that, but Dr. Hicks can speak to it more directly. Yes, there was a dissenter. We have dissenters in the Army organization, too.

Mr. SKELTON. When did OSD approve of the manner of test about which we are talking?

Mr. AMBROSE. The phase 1 test was approved——

Mr. SKELTON. No, no. I am talking about the—well, let's make sure we are talking about the same thing.

Dr. HICKS. Phase 1 testing is the thing to talk about first.

Mr. AMBROSE. There is no approved phase 2 test plan yet. It has been——

Mr. SKELTON. Have you done some phase 2 testing?

Mr. AMBROSE. We started to and then it was suspended.

Mr. SKELTON. Without an approval? Wait just a minute. You have done some phase 2 testing without an approved plan. Is that correct?

Mr. AMBROSE. We considered that we had an approval from OSD. Dr. Hicks can expand on this.

Mr. SKELTON. Did he?

Dr. HICKS. That's right. The reason that we are now going to such a detailed plan, sir, is because of all the controversy. We did approve, we talked about and approved——

Mr. SKELTON. When was that approved, sir?

Dr. HICKS. Early in the year. I have forgotten exactly when.

Mr. SKELTON. January? February?

Mr. AMBROSE. I think it was January or so.

Mr. SKELTON. So there was an OSD-approved plan——

Dr. HICKS. February 24.

Mr. SKELTON. The 24th of February there was an OSD plan approving of your testing?

Mr. AMBROSE. Yes.

Mr. SKELTON. And did you comply with that testing procedure?

Mr. AMBROSE. We started to and then the testing was subsequently suspended.

Mr. SKELTON. Why? First, who did it? Who suspended it?

Mr. AMBROSE. It was suspended by the Secretary of the Army——

Mr. SKELTON. All right.

Mr. AMBROSE. Who said, "There has been too much question about the integrity of this testing. Now stop and let's see whether that is so or not."

Mr. SKELTON. All right.

Mr. AMBROSE. There was an investigation and at an earlier time—I think you were perhaps not here—we spoke quite strongly, Dr. Hicks and I—and the Vice Chief of Staff of the Army, who is not here, was party to this as well—that we find no evidence of lack of integrity, so that condition has been——

Mr. SKELTON. Then did testing on phase 2 proceed? Is that correct?

Mr. AMBROSE. No. Testing remains suspended until in our judgment, both Army and OSD, we are able to provide sufficient detail that there will be no question in anybody's mind as to where the water cans or anything else is or ought to be, and all of these very detailed matters. That detailed test plan is in front of OSD today, as a matter of fact, and we anticipate agreement in time to meet the requirements of this subcommittee to put it in front of you before we proceed.

Mr. SKELTON. Now, Mr. Ambrose, there was an approved draft plan, as I understand it, but it was not a detailed test plan. Is that correct?

Mr. AMBROSE. Yes.

Dr. HICKS. Actually it was called an outline test plan, sir, and it was general in nature.

Mr. SKELTON. Well, that is not what he said. A while ago he said there was an approved plan. Now which is correct?

Dr. HICKS. It was approved. That's right.

Mr. AMBROSE. Yes.

Mr. SKELTON. Well, yes, which one?

Mr. AMBROSE. Yes, there was an approved plan.

Mr. SKELTON. A detailed test plan. Is that correct?

Dr. HICKS. No.

Mr. AMBROSE. The level of detail is really what is involved here. The plan which we considered approved was one that said generally what it is we are going to fix.

Mr. SKELTON. That is the February 24 plan?

Mr. AMBROSE. Yes.

Mr. SKELTON. Is there something to come after that?

Mr. AMBROSE. More details of the same plan.

Mr. SKELTON. Has that been done yet?

Mr. AMBROSE. It is in the process. It is in front of OSD.

Mr. SKELTON. All right. Now when are we going to do that, then?

Mr. AMBROSE. We will have that approved in the next week or so.

Mr. SKELTON. And then what?

Mr. AMBROSE. Then we will restart the testing.

Dr. HICKS. I think the important point to make here is that I was perfectly satisfied personally with the outline test plan, and that is why I approved it. When we got into the details of the tests, it turned out there were some misunderstandings by one of my individuals, again, about the plan.

Mr. SKELTON. That is not the Army's fault. Is that correct?

Dr. HICKS. Not the Army's fault at all. I mean, it was just that——

Mr. SKELTON. It came out of your shop. Is that right?

Dr. HICKS.There were in fact disagreements by someone in my shop about the details, some of which had to do with things like changing water cans and so on.

Mr. SKELTON. Therefore, as far as we are concerned, the Army did nothing incorrectly in this whole series. Is that correct?

Dr. HICKS. That's right. That's correct. What we did, then, in order to preclude that kind of continual nonsense, is decide to make a test plan that was so specific that we would tell persons exactly where to put every little thing, so that nobody could change that plan and nobody could get involved in protesting that plan. That is what we have done.

Mr. SKELTON. And that is what you are doing?

Dr. HICKS. Right.

Mr. AMBROSE. Let me make sure that there is one ingredient of this that is understood. There is another aspect of the prospective or future tests that has not been discussed, and that is the creation of a so-called minimum vulnerability vehicle in which the ammuni-

tion is put on the outside of the vehicle. That is an issue that is not included in what we have said. We don't yet know how to build a feasible vehicle of that sort. We have agreed with OSD, though, that we will put an intensive design effort to see if we can come up with an operationally feasible vehicle of that sort, and as soon as we can we will test it. Therefore, that is not included in what both Dr. Hicks and I are referring to in phase 2 testing, but that is an academic matter. We should not hold the rest of the testing hostage to the eventual devising and testing of that vehicle. We will do that as a further project.

Mr. STRATTON. Mr. Ray.

Mr. RAY. Mr. Chairman, I don't have any questions but I do want to thank the gentlemen for coming and examining this in great detail. It is very helpful to us all.

I yield back my time at this time, Mr. Chairman.

Mr. STRATTON. Mr. Bustamante.

Mr. BUSTAMANTE. Mr. Chairman, I have one question and I would like to submit others to be answered for the record, if I may.

Mr. STRATTON. Without objection.

[Questions and answers at end of hearing.]

Mr. BUSTAMANTE. Let me say, Mr. Secretary, that the driving factors behind congressional concern over the survivability of the Bradley are the 18-year-old infantrymen riding in the Bradley, as well as the budgetary pressures that Gramm-Rudman is exerting on all defense expenditures. If we are to understand that the Bradley, as it stands, is vulnerable, and that therefore it needs survivability improvements, wouldn't we logically be faced with two possibilities?

One possibility would be to stop the Bradley production line until we finish the testing of the necessary survivability improvements for the Bradley, since without those improvements we wouldn't want to send infantrymen into the battlefield. The problem with this approach is that it would take between 1 year to 2 years to complete the test, and it would become prohibitively expensive to restart the production line after that much idleness.

The other possibility would be much cheaper. What makes the Bradley most vulnerable is the TOW and the 25-mm Bushmaster gun ammunition, which if removed would make the Bradley more survivable. However, the Bradley without the TOW and the Bushmaster cannon ends up looking like an expensive M–113. Would logic therefore dictate that it would make more economic and safety sense to use M–113's to transport infantrymen, especially with the transmission improvements they are undergoing, and use the ITV—the improved TOW vehicle—that we already field to take up the mission of the Bradley's TOW?

Secretary MARSH. Congressman, let me first make a response, and I think part of that response should come from the Chief of Staff of the Army because you are getting into tactical employment of vehicles, and I think he can give you some insights on that. The technical questions that relate to ammunition storage, the two gentlemen on my right can answer far better than I.

However, let me say to you that I really appreciate your concerns in reference to 18-year-old infantrymen. I know of your own background in the 101st Airborne. I would say to a Member of Con-

gress that not to proceed with the acquisition of the Bradley is really not helpful to the American infantrymen because the Bradley, as it exists now, of its kind, is better than any type of its kind in the world. There are none in the world that can match the Bradley.

What we are talking about is even making the Bradley a better vehicle, because we have learned something from these tests on fire suppression, use of spall liners, things of this type, and those are very important. We want to make those improvements to the Bradley, as we do with other vehicles as we go along. Some things we can go back and catch up. However, to deprive the infantrymen today of the opportunities of having that vehicle I think is not in the best interests of the Army or of our service, and I would not encourage the Congress to do that.

Now you have raised the question as to alternatives, and I think they deserve to be addressed because I think you have raised some very important insights there, and I am going to refer you to General Wickham.

Mr. BUSTAMANTE. Well, let me say my concern is to put all these young men in a vehicle that is so vulnerable, and this is my biggest concern.

Secretary MARSH. Of course, the M-113 is probably more vulnerable than the Bradley. What you are now doing with the Bradley is subjecting it to a series of tests that go over and well beyond what it was ever intended to do.

Mr. BUSTAMANTE. But are we not moving the Bradley 3,000 meters behind the main lines? Isn't this what we have said?

Secretary MARSH. The secret for the employment of the Bradley, from the standpoint of its own security, is the tactical employment, whether it is the Bradley or whether it is the M-113, and I think General Wickham can speak to that better than I.

General WICKHAM. One of the things, Mr. Congressman, that we decided on years ago with, I think, good wisdom, was to increase the density of antitank systems in the battlefield environment in Europe by putting them on the Bradley, and that was the genesis of the capability. As the Secretary indicated, there is no vehicle that is in design or that we have already that is better suited than the Bradley in terms of providing protection to the infantry soldier and in terms of providing lethal firepower in support of the infantry.

The concept of using M-113's, M-60A3's, and using the ITV's is not cost-effective. We have looked at that. Nor is it combat-effective. It is more complicated for the infantry leader to manage that combination of vehicles than having the lethal fire support as well as a transporter in the Bradley that we have today. Furthermore, the combination of ITV's and M-113's provides less capability as well as less protection for the infantry. You know, one of the issues about vulnerability is related to speed, and the faster vehicles go on the battlefield, perhaps the less vulnerable they are.

Therefore, we have looked at this as an alternative. It doesn't make sense tactically and it really doesn't make sense in a cost-effective way. It would be a mistake, in my opinion. In the uniformed opinion side of the Army, it would be a mistake for Congress to suspend production of the Bradley because we want to test

this or test that and see what the results are going to be. I think we need to press on. We are already woefully inadequate in terms of conventional capabilities in Europe.

Mr. BUSTAMANTE. We have to go vote but I will yield to my friend.

Secretary MARSH. Did you have a further question on the vulnerability of that ammunition you wanted answered?

Mr. BUSTAMANTE. Well, I have submitted my questions for the record. Why don't we do that so you can——

Mrs. BYRON [acting chairman]. We are going to have to recess for 5 minutes. The first shift has gone to vote. They should be back in a few minutes, so the second shift will now go.

[Recess taken.]

Mr. STRATTON. The committee will come to order.

The gentleman from South Carolina, Mr. Spratt, has a couple of questions.

Mr. SPRATT. Thank you, Mr. Chairman.

Secretary Ambrose, you indicated that as the production of the Bradley moved along, the world of armaments moved with it, and this was one reason the live-fire testing was decided upon. Was there any live-fire testing of the original production unit—and I direct this to the whole panel, whichever one is the best to answer it—prior to the most recent series of live-fire tests?

Mr. AMBROSE. Yes, it had a specification, Mr. Spratt, to be resistant to 14.5 millimeter fire and overhead shrapnel fire, and it was tested back in the development phase successfully against that specification.

Mr. SPRATT. This was the series of tests, then, conducted by FMC?

Mr. AMBROSE. Well, it was conducted, as I think I said earlier, at Aberdeen Proving Ground I believe, development tests are normally supervised by the Army—in this case TACOM—and by the Army Test Command, which is set up to independently conduct tests.

Mr. SPRATT. For my own clarification—and it may have been answered already—at what point and by whom, then, was it decided to initiate a new series of live-fire testing?

Mr. AMBROSE. It was decided mutually by the Army and by OSD, and I think by OSD on a broader front, that live-fire testing should be conducted of a number of the Defense Department's systems, and that the first of these would be the Bradley. That was done in 1984.

Mr. SPRATT. I see. Therefore, this was part of an overall decision to conduct live-fire testing of a number of systems?

Mr. AMBROSE. Yes.

Dr. HICKS. Mr. Congressman, if I could add to that I would point out that the authorization bill last year of the Congress requires live-fire testing of tracked vehicles.

Mr. SPRATT. Right.

Mr. AMBROSE. I would, if I may, make a footnote point. The M-1 is to be tested as well. We have taken the M-1 out of the joint live-fire program in order to test it sooner, and that has been done with the approval of OSD, so it is not a matter of foot-dragging here. It is a matter of test resources and detailing of test plans and

the like. I think we all agree that we probably should have sooner, and in any event now should catch up to more experimental work along these vulnerability lines. I don't think there is any disagreement about that. There are interior disagreements, at least, by a few individuals as to exactly how to go about it.

Mr. SPRATT. We have had, as you know, several hearings on this issue. General Thurman testified once and I asked him if, in his opinion, the experience with the Bradley demonstrated the need for more rigorous testing earlier in the initial production decision phase, and he agreed that it did exemplify that need. Would you agree with that, that we need more rigorous and more independent live-fire testing earlier in the production decision phase?

Mr. AMBROSE. Yes; I agree with it, and I would like to expand just a little bit on that. We are putting into effect that vulnerability considerations will be a standard part of the approval decision process through the Army System Acquisition Review Council [ASARC] and, I presume Dr. Hicks will agree, through the—DSARC—[Defense System Acquisition Review Council] process where they get involved, so that we intend to force this aspect of the weapons systems to the front from the very beginning of the decisionmaking process.

The testing I would expand this way. I don't believe that there is enough tea in China or enough money in the Defense budget to do all of the testing, live testing, that one could imagine would be necessary to get an adequate statistical basis. I think we have to depend on the evolution of more detailed computer models. I think the most obvious example of where this has had very great success is in the development of nuclear weapons, which to a large extent proceeds by the use of supercomputers and means of that sort.

What we are trying to do in the Bradley testing and will continue to try to do in other weapon systems tests is to learn from these tests enough to be reasonably sure that the models, then, can be relied upon to get large statistical trials in effect. It is a normal thing that is now within our power with these large-scale computers, so I don't think we ought to see testing as standing off by itself as the only thing to be relied upon. That is why, in part, we have so firmly advocated that when we run each shot, that we instrument it very thoroughly, we run the shots in particular directions, so that we can then calibrate and correlate that information with the computer programs.

General WICKHAM. Let me, if I might, Mr. Spratt, add a little bit to that. I am not sure that we need to move down the road of testing as far as maybe the Vice Chief of Staff suggested here, or even Mr. Ambrose. We know that if we employ the Bradley like a tank and it is hit like a tank, it is going to get blown away. It is not designed to be a tank and we don't intend to employ it as a tank. There are some things we can do in the way of tactics which we are conducting in training that will minimize the risks to it, and there are some reasonable things that we can do to minimize the risks and reduce its vulnerability if in fact it gets itself into a position where overmatching weapons do hit it. However, it must be abundantly clear to everyone that we don't intend to use the Bradley—never did, don't now, never will—to use it as a tank against

the kinds of overmatching threats that we are testing it for in the phase 1 and phase 2 live-fire tests.

Mr. SPRATT. Dr. Hicks, you have stated in your testimony that as a result of the phase 1 testing completed in December 1985, a number of findings were resolved. There were certain things that were finally determined, and they are listed there in your testimony.

Dr. HICKS. Right.

Mr. SPRATT. Do any configuration decisions follow at this point from those findings?

Dr. HICKS. There were some decisions about what to do to reduce those vulnerabilities; for example, testing two kinds of reactive armor, the spall liners, the movement of the munitions to the rear and lower in the Bradley. There were decisions made that would then be tried out in phase 2 to make sure they were, in fact, a reasonable thing to do.

Mr. SPRATT. I see what you are saying. As I understand what you are saying, basically these findings led you to further definition of the protocol for phase 2 testing, and not to any final configuration changes.

Dr. HICKS. That's right. In fact, the phase 1 tests were really designed to tell us in live fire what some of the vulnerabilities were. We obviously know some of these things anyway, but we needed to validate what we could do because of increased threats and because we have newer technologies to deal with that, like reactive armor. Therefore, based on those tests which were reported to you in December, we came up with different schemes to try to reduce that vulnerability and then to test the vehicle again to make sure those were going to work all right.

Mr. SPRATT. As I understand it from your testimony, we have before us pending the outcome of the phase 2 tests, a number of configuration decisions. One is reactive armor. Another is spall liners in the interior compartment. Another is the storage of fuel and ammunition containers, and also apparently fuel lines and the fuel system. Another is the fire extinguishing system and the use of Halon. Another is what to do about overpressure casualties, if these indeed are a problem that can be mitigated. Finally, there are some minor configuration changes along the shot line that might be considered. Are there other configuration changes that are under consideration?

Dr. HICKS. I will have to ask Mr. Ambrose.

Mr. AMBROSE. There are a number of things. Rearranging the fuel system, for example.

Mr. SPRATT. Now the question I am leading to is this. You are asking this year for 870 additional Bradley Fighting units. We have purchased about 3,000. Our total buy will be about 6,800. If we budget for 870 this year, we will have purchased between 70 and 75 percent by the time we know the answer to these configuration questions. Why shouldn't we withhold production or cut production substantially, pending the decision about configuration changes?

Dr. HICKS. Well, Mr. Congressman, I think it is again the issue of risk and the better being the enemy of the good. I think we have to worry about what might happen at any time. The Army is short of the number of Bradley Fighting Vehicles it needs, so I suppose if

we were convinced there would be no need to use them, we could even disband the whole Department of Defense until such time as we have to have them back again to meet the threat.

I worry about the issue of what the Army has to do with those vehicles at any given time, and I would rather see the things that go along that are tremendously important to the Army to fill its requirements as we try to make the improvements, but it isn't unusual. I mean, we are focusing on the Bradley today but we do this routinely in almost everything we do. We have what we call product improvements, as you know, to engines which we change all the time. As we see, we have block changes in almost every production program we have and, if we can, after that block change we go back and try to retrofit if it is economically feasible to do so.

You know, the Soviets have a very interesting production system. When they start something, they keep building it. New things come on line and they add those. Now that makes them and puts them in a position where they have lots more available to them—and I know you know this as well as I do—to be much more competitive to us. I think that we should continue with the Bradley on course, work as rapidly as we can to see what we can do to improve it, make those improvements as soon as we can, and make a block change then in the Bradley Fighting Vehicle.

Mr. AMBROSE. I think there is another—excuse me, John—there is another more mundane financial consideration. It will cost money to shut anything of this sort down. It will cost money to start it back up again. The supplier chain will be broken, and there are long lead money commitments and so forth. Most of the changes we are talking about are capable of being retrofitted. The reactive armor, for example, will just be hung on the outside. As a matter of fact, the provisions will be made in such a way that we can change the reactive armor because we expect it to evolve over time, so I think that it is simply a more costly process to stop and restart than it is to build these vehicles and, as appropriate, retrofit and change them.

I am sorry, John. Go ahead General Wickham.

General WICKHAM. Well, I was going to say the same thing, but also that the M1's are coming into the system, thanks to the support of the Congress, and to the extent now we slow down the production rate of the Bradleys, we are going to have a force structure disconnect. We are going to have mechanized infantry without the capability to fight as a part of combined arms team to its full capability out there.

Also, the point I think has been well made here that, like all systems we must continue to product improve. All of these things that we are talking about evaluating in phase 2, these product improvements, can be retrofitted on every Bradley that we have, both the scout vehicle version and the infantry-carrying vehicle version, easily.

Mr. SPRATT. Sure. I know it is a complex financial decision, but retrofits cost money and normally they cost more money than initial production, incorporating the change in the initial production. Also, I know we have product improvement programs, and usually when we put a new engine in we wear out the first one before we insert the new one.

Dr. HICKS. For example, in engines like the F-16's we are still building F-16's but we have in fact product improved the engine from the first. The F-100, the first F-100, you know, was much different than the present F-100 by a big factor, so that they are improved in terms of reliability, they use different materials, et cetera, et cetera.

I think that the point that Secretary Ambrose made is a very valid one. I suspect it would be fairly easy to prove to you the economic issue in terms of the retrofit, that it would not be economic to shut the lines down.

Mr. SPRATT. I am not talking about shutting the line down. That is an alternative. I guess on this continuum that is one pole of the options before us.

When do you think we will have a decision on configuration changes?

Dr. HICKS. We hope to have a report, and I think we will have to ask that Mr. Ambrose concur, but we should have a report on everything by the end of December before Congress. Is that the time you see?

Mr. AMBROSE. Yes.

Mr. SPRATT. And following that there would have to be engineering design studies done, and it seems to me that we may build all of these before we finally can decide how to reconfigure them.

Dr. HICKS. Very straightforward. The engineering issues here are more mechanical than anything. They are very straightforward.

Mr. AMBROSE. The design to introduce them into production, if they should be accepted, is ongoing so that it is not an in-series matter. Some of those changes will undoubtedly not be adopted as being necessary or cost effective, but the ability to cut them into the production line is aimed at spring or late spring of next year.

Mr. SPRATT. Thank you very much.

Mr. STRATTON. Thank you, Mr. Spratt.

Mr. Secretaries and General Wickham, I want to express my appreciation for your remarks today. We are looking forward to the fact that you will return with an approved detailed test plan no later than the 6th of June, and at that time we will also expect a discussion of testing the OSD minimum casualty vehicle.

Mr. Levine is here and I think he may have some questions, but I am an hour and a half late for a luncheon engagement, and Mrs. Byron will assume the chair in my absence.

Mrs. BYRON [acting chairman]. Mr. Ray, did you have some questions earlier?

Mr. RAY. Yes.

Mrs. BYRON. Mr. Levine, do you have some questions?

Mr. LEVINE. Yes, Madam Chairman. Thank you very much. As the chairman is leaving, I would like to thank him for his leadership in the area and for calling this hearing, and for inviting me as a nonmember of the committee but as someone interested in the subject and someone interested, with other members of the Military Reform Caucus, to participate in this hearing. I am grateful to you, Mr. Chairman, and I want to thank you.

I also want to thank the gentlemen for their testimony today. I have been able to sit through most of it. Unfortunately, I wasn't

here at the very beginning but it has been very helpful and I am very appreciative to all four of you.

I would like to have a few questions. I don't want to unduly prolong the hearing. I do want to pursue a little bit further the questions that Mr. Spratt was asking with regard to just the timing and significance of the tests with regard to reconfiguration. I think I would like to make a preliminary statement in asking the question, which is that I think that the general issue is clear, that the point of the testing—whether it is on reconfiguration or any other element of the live-fire tests, has never been to stop the Bradley but to stop unnecessary casualties. I think that that has been addressed by other members of the panel today, and I think that that should be stipulated at the outset.

If I understand preliminary test results accurately—and please correct me if I am wrong—I think that they have indicated that the ammunition and fuel being stowed inside the Bradley increases the likelihood of casualties some two to three times, No. 1. I don't know if that is accurate but that is my understanding. I would be interested in your response on that.

If that is true, I have a difficult time understanding from a time-frame perspective how Congress or the Army can really decide on improvements without first testing a rough version of the Bradley with the fuel and the ammunition stowed outside. If we are talking about a December date, I see that as creating a procedural problem in terms of providing us with the information that we have been seeking with regard to the testing of the reconfigured vehicle.

Mr. Ambrose. If you would allow me to start with a fact of life that is disagreeable, if you hit a TOW missile round that is mounted on the outside of the turret—and I will explain why the turret in just a second—you may well know all of this but I think it would be beneficial to use that—and this TOW is not held away from the turret by something on the order of 10 to 12 inches, it will blow the turret apart. If you then mount these TOW's around the turret as densely as you can— and that is six, approximately, then you can't get the hatch open to get at them. Therefore, in order to get at them and fire them, you have to stop the vehicle, let the back gate down and, go outside. It is not at all obvious to any of us why that is a reduced vulnerability to the individuals that we are trying to protect here.

Therefore, our reaction to that kind of proposition is, first we have to find out if there is some feasible way to mount these TOW's up more closely to the turret; otherwise we are just changing one form of the problem for another. The other four, assuming that we retain the same load of missiles, have to go someplace else where they can't, so far as we have been able to mock it up—and these mockups have been shown to those who advocate the outside stuff—where again you have to get outside to get at them and then bring them inside.

We have a design crew working very vigorously to see if we can figure something out that is operationally suitable, but our view of it—mine in particular—is that to just simply create such a vehicle and go show that it does or does not improve things to some extent would simply lead to the challenge, "Well, you haven't got an operationally suitable thing, so what are you doing that for?"

Dr. HICKS. May I add to that?

Mr. LEVINE. Please.

Dr. HICKS. I think this illustrates something that I touched on earlier. Whenever you go into a design of a complicated vehicle of any kind—aircraft, tank—there are always tradeoffs you have to make, tradeoffs you have to make because of vulnerability of the crew, because of the operational utilization of this vehicle, and so on. Sometimes we do things, for example, with a tank that we have to put a lot of armor on it because we expect it to be in a certain place. That gives us a lot of trouble with maneuverability. It is heavy, won't move very fast in some situations, so all those trades are subject to the people who are human beings that are trying to decide what best way to make that vehicle.

That is the reason, of course, that when you get into a situation of live-fire tests or any kind of a design of a vehicle, you will find disagreements. You will find disagreements among honest people who will have their own points of view because of whatever—their backgrounds or what they took in school, or who knows all the possibilities—how they got out of bed that morning, perhaps. Somebody in that organization who is the manager has to make the decision. Now he is responsible for that decision and has to take the consequences of it, so what we are saying here is that the best minds have thought about the problem and are still thinking about it because of the situation.

Someone eventually is going to have to say, because of the overall systems aspects of it, even if it meant, for example, that perhaps you could reduce the casualties inside the vehicle by putting something outside the vehicle, if it weren't operationally significant to do that you could really reduce casualties by leaving them home. That would be the best way to reduce casualties. He has to be out there fighting a war in an operationally significant way, so somebody has to make a decision about how we do that. I think that is where a lot of our trouble comes because the way we are set up now, anybody who may have a disagreement about the final decision about how the thing should look or operate can delay the program forever and ever.

Mr. AMBROSE. Let me give you another example of the kind of problems that are involved here. I just talked about the TOW's. They are kind of an obvious thing, but then you say, "Where do I put the fuel and the ammunition?" The answer is, about the only place left to put it is on the side skirts of the thing, unless you want to make it unwieldy and long. Well, the vehicle is already subject to criticism—I have criticized it myself—for being too wide. Making it wider is certainly going to worsen that. We already have to take the armor plates off the sides—and that is I think something that is undesirable in itself—in order to load it on an airplane, and we have to put it back together after we get where we are going. Now if we put the fuel and the 25-millimeter ammunition on the outside of those skirts, we have compounded that problem without necessarily having gained anything for it.

In saying these things, I say them just to illustrate that it is not quite so easy to solve the issues as some of the people with a sketch pad would have you believe. We have a group seriously looking at what we can do to get things outside the vehicle and do it in an

operationally sensible way, and as soon as we figure something like that out, if indeed we do, we will take it off and test it. But we don't believe—and this is where we are in disagreement with the vocal advocacy of this other route—we don't believe that we should stop or hold hostage the things that we have already laid out, until and if we can find that out.

Even if we had such a test, it would be necessarily an early development test that would have to be followed by operational testing. As you know, we get pretty heavily criticized for not doing enough of that. Introducing such a thing into production I think is several years away from now. Should we hold up everything else we can do until then? We do not believe so.

Mr. LEVINE. I appreciate both your answers, Mr. Ambrose and Mr. Hicks, and I particularly appreciate the dilemma that Mr. Hicks outlines where you do have a situation which I think we all understand, where honorable people can differ with regard to this both inside your operation and from here as well. Frankly, one of the reasons that this is a useful hearing is because it gets some of these exchanges out in the open in a candid fashion, which is something that I think is helpful in terms of process, and I appreciate that.

Just in terms of your response, Mr. Ambrose, it sounds like—if I understand your testimony correctly—that you have in fact not made a decision yet, whether or not the reconfigured vehicle can be tested. I was under the impression that the Army had agreed to test a reconfigured vehicle and to test it side by side with the prior vehicle, and correct me if I am incorrect by that understanding.

Mr. AMBROSE. That representation was made over here but it is not correct. In particular it was not correct that it could be done in the timeframe of the next month or two. Our estimate from early on had been that just simply literally making a mockup of that sort that had been proposed would require time until October or November of this year. We looked at having the prime contractor build such a vehicle. Then we tried to foreshorten that a bit by getting one of our own inhouse depots to do it instead. Neither one could come up with a scheme that would get it done before the fall.

Therefore we have, as you said, not committed to test such a thing. We have a design outfit trying to find an operationally suitable scheme that includes experimental work to see if we can figure out how to reduce the standoff distance and how to feed 25mm ammunition in from some removable outside container, and how to feed the fuel and so forth, and we will keep at it.

Mr. LEVINE. So the perception that the Army had committed to test a minimum casualty base line vehicle is not an accurate perception?

Mr. AMBROSE. There was a request to accomplish that but they had not agreed to it.

Dr. HICKS. Let me make a point on that. If we came up with a kludge to do that test, we almost can tell you right now that if we had the proper standoff distances and this, that, and the other, that we could reduce casualties inside. The fact of the matter is, we don't now know how to build that vehicle so it is operationally suitable, so until we know how to design the vehicle, it may never happen, so that we don't force people to go out different ways, et

cetera, or we have to cut holes and put mechanisms in so they can reach through from inside. All these things are very complicated in terms of the design of the vehicle.

Now it's the kind of thing that in an airplane, if you decided that was the thing to do, for different reasons, that would be the next airplane you would think about. Maybe we can find some way to build a better Bradley, we hope, to reduce casualties, to be more effective, to be faster, and so on. When that happens, we would have to look at this and see if that is possible.

I think the Army is being very responsive here, in that they are trying to find a way to design something that will make sense so that if they can find it, they can go ahead and do this test, but to me to waste the time and money to put a kludge out there just because it happens to be out there, I think that would not be engineeringly correct.

Mrs. BYRON. Would the gentleman yield for a moment?

Mr. LEVINE. I would be happy to.

Mrs. BYRON. Mr. Ambrose, I believe you just said the Army hadn't decided to do the test, and had been directed by OSD. I have, and it is my understanding on February 24 the Under Secretary—and I quote here—"No report should be issued and no production decision made on the final configuration changes until test results from this configuration are available and compared to the test results from the configuration proposed in your outline test plan." It's on page 25.

Mr. AMBROSE. I think you mean the Under Secretary of Defense for Research and Engineering don't you, Congresswoman?

Mrs. BYRON. Yes.

Dr. HICKS. No, there is nothing. Actually they are not inconsistent because they are trying to find a way to build the vehicle so they can test it. They are committed to do it if they can in fact find a way to do that. What I have here is a memorandum that I have sent to the Vice Chief of Staff on the 24th of February that discusses in fact "a proposed vehicle configuration that stores fuel and ammunition either externally with sufficient small arms protection or in externally-vented compartments. A description has been provided to his staff. A proposed shot plan involving approximately 10 shots, including one mine shot, has also been provided. We understand from the Bradley program manager that this vehicle will be ready for test by 1 May." Now, "No report shall be issued and no production decision shall be made on the final configuration changes" until that is done.

We found—this was February 24—when the Army looked into that to try to find ways of making that a reasonable operational vehicle, they still have not been able to find a solution. Therefore, I would say that we are not inconsistent. If they can find one, then we will test it.

Mrs. BYRON. You are not inconsistent; you are just different.

Mr. AMBROSE. Well, Madam Chairman, let me take the whole hit for this thing. We may well have had people who were trying to accommodate this request, believing that it could be accommodated, saying, "Yes, we will do it." I am the one who said, when I heard about it, "What is this? That doesn't make any operational sense. We will just simply get hit from that side as soon as we have

done this." Therefore, I stopped it. So any representations before that were overtaken by me, and if that is inconsistent or a contradiction, I am responsible for that.

Dr. HICKS. But it isn't inconsistent with my statement, because in my statement I point out that we expect the design concepts from the Army to be ready by December of this year. If Mr. Ambrose is correct in his engineering judgment, they won't be able to find such a design. If they can, we will then proceed to build it and test it.

Mrs. BYRON. And yet we are being asked to put in procurement for 870 vehicles this year, without having the test results that have been requested.

Dr. HICKS. But, Mrs. Stratton—Mrs. Byron—you've got the wrong sign in front of you.

Mrs. BYRON. Mr. Stratton will be very surprised.

[Laughter.]

Dr. HICKS. Mrs. Chairwoman, I think we can go back over the issue again of what we get out of the Bradley in its present configuration. We are doing something now to try to improve it to another level by adding the reactive armor. We would eventually hope to have another approach, which will save lives inside. That could be the next vehicle.

Mrs. BYRON. If that is the case, though——

Dr. HICKS. Yes.

Mrs. BYRON. I am sure we are not going to find, with the modifications, the vehicle coming in at the same price as the one that we are talking about procuring, and the procurement issue is the procurement dollars.

Mr. AMBROSE. You are right, absolutely.

Dr. HICKS. My belief is that this——

Mrs. BYRON. So by that you are telling me that if we are going to make the modifications, we best wait and not procure this year?

Dr. HICKS. No, no.

Mr. AMBROSE. I think you could stop the whole defense budget on that line of reasoning and stop everything, because we have product improvements in some stage or other on almost everything.

Mrs. BYRON. OK.

Mr. Levine, I am sorry to interrupt you but that was a point that I——

Mr. LEVINE. Well, I appreciate your interruption, Madam Chairman. I think it is significant.

Unfortunately we have the bells ringing again, but I think that you gentlemen can understand the frustration that some of us feel. After the phase 1 testing, the famous report that has been the subject of so much discussion, as I recall it—and I do not have it under my nose—but as I recall it the report, after phase 1, specifically assured the Congress that this testing would be done.

Mr. HICKS. That's right.

Mr. LEVINE. It is difficult to sit here several months later, knowing that that explicit representation was made by the U.S. Army and now we are being told that that can't be met, but let me just——

Dr. HICKS. Please let me answer that before it sits there that way. Actually the desire to do the testing was absolutely straight

and we wanted to do it. However, when you look into the testing from an engineering viewpoint—in fact, on February 24, I issued another directive that said they would look at ways to do this—if you look at my statement for today, you will see that they have been unable to find a way to do it yet, to meet that requirement in an operationally significant vehicle, so it doesn't make sense to proceed on something that doesn't make sense.

Mr. LEVINE. Well, Mr. Hicks, I understand your frustration. I understand the difficulty and difficult position you are in. I hope you will understand ours as well, which is that we were basing judgments that we made on the statements and representations that we got, and that was the best that we could do at that time. Circumstances do change, but we did have that understanding, if not assurance, at a prior date.

Dr. HICKS. I think you now see the problem in what we are doing, and I would say that what we are doing and what we can do will significantly improve the Bradley, and it will be reasonably cost effective. However, I am not convinced that we can either operationally do the other or that it would be cost effective.

Mr. LEVINE. Let me just try to get brief answers for a couple of questions, because of the voting situation.

I made a variety of requests to the Army in 1984 on this issue, and Chairman Stratton sought answers when I wasn't able to get the response myself, and received a response in May of 1984 to some questions that I had asked earlier that year. In response to one of my questions with regard to maintenance, the letter signed by General Franklin dated May 15, 1984 states, "The maintenance record of these vehicles," referring to the Bradleys, "is excellent, with operational readiness rates averaging over 90 percent. Separate evaluations by the Operational Test and Evaluation Agency and the TRADOC Combined Arms Test Agency support the conclusion that the Bradley is fully maintainable by soldiers. There have been instances of spare parts shortages, resulting from a combination of design and quality control deficiencies, of two major components, the transmission and the integrated sight unit. However, intensive management has reduced the impact on fielded units to a minimum."

Now I was recently handed a newspaper article last week from the Newark Star-Ledger which reports—and correct the report if this is inaccurate—that:

> The Army is paying to repair the transmissions of thousands of its new Bradley Fighting Vehicles, transporters which carry infantry onto the battlefield. The Army, already paying $1.3 million for each Bradley, will pay several million dollars more to fix the transmissions of many of the 2,500 vehicles already in the field. Lt. Col. Craig McNabb, an Army spokesman, was quoted as saying the Bradley transmissions "haven't all broken, but they do tend to break."

I am concerned about this report in light of the assurances that I received several years ago with regard to the transmissions. I would like to know how the two square, and I would also like to know why the contractor isn't paying for the breakdown of the transmissions. If in fact this is a problem, why wouldn't this be covered by the warranty legislation that we enacted?

Mr. AMBROSE. Could you accept as a short answer that we will get you a full response to all of that?

Mrs. Byron. I was going to say, Mr. Levine, would you mind, since we do have another vote on the floor, to get them to submit for the record and also to your office the answers to those questions?

Mr. Ambrose. You will have it this week.

### BRADLEY WARRANTIES

Prior to FY 1983, the HMPT-500 transmission was procured as part of the end item Bradley Vehicle from the FMC Corporation. This contract provided for a "Correction of Deficiencies" clause; no warranty coverage was provided. A warranty cost of $2,800 per unit is applicable to FY 1983, FY 1984, and FY 1985 requirements. The warranty is "failure free" in nature, and GE is liable under this warranty for all repairs for a period of one year after acceptance of the end item Bradley Vehicle.

The warranty cost for FY 1986 is $808 per unit for the 716 transmissions to support new vehicle production. The warranty will be failure free prior to integration into the vehicle at the Prime Vehicle Production Contractor. A "threshold" provision will hold GE liable for failure threshold based on current performace of recently fielded units and test transmissions. (The warranty will also include lot defect protection of non GS/Depot repairable covered items). The warranty will cover workmanship, material, redesign and essential performance characteristics. Coverage on individual transmissions does not provide for specific reliability requirements, i.e., Mean Miles Between Failure.

Mr. Levine. That would be fine, and to shortcut this, perhaps I could submit my other questions for the record and we could get those responses.

Mr. Ambrose. We will see that you get the answers as promptly as we can.

Mr. Levine. That would be fine.

Mrs. Byron. Let me once again thank the four of you for a hearing that has been very lengthy this morning. I appreciate your candor and your time.

The chairman has asked me to announce that we will keep the record open for 5 additional days for questions and other material, including the staff report, that will be made a part of this hearing record.

[Staff test program report at end of hearing.]

Secretary Marsh. Thank you, Madam Chairman. We appreciate the opportunity to be here. My statement was for the Chief and myself jointly when we opened. I don't know whether General Wickham wants to make any comments at this time.

General Wickham. Thank you, Madam Chairman. I would just like to make one last comment. I have heard a lot of comments from Members here about constituent concerns. I am speaking for the uniformed constituents in the Army. They like the Bradley. They need the Bradley to go to war if we are obliged to do so. There is no vehicle on the horizon that can meet its capabilities, and the testing that we are doing now is designed to improve its capabilities. The product improvements are going to make sense to do and they will be cost effective. Thank you.

Mrs. Byron. Thank you all.

SURVIVABILITY TESTING FOR ANTI-TANK WEAPONS

Mr. Bustamante. How many U.S. Army armored vehicles currently in the field have been survivability tested for anti-tank weapons? Will we have to go through this entire Bradley sequence on each untested vehicle? Please explain.

Mr. Ambrose. Bradley and M113 are currently being tested. The M1 Tank testing will start when Bradley Phase II testing is completed. Vulnerability testing of all future wheeled or tracked armored vehicles is required by Chapter 139 of title 10, United States Code, that takes effect on January 1, 1987.

SOVIET RPG-7

Mr. Bustamante. How long has the Soviet RPG been in production? We are told that the Soviet/Warsaw Pact continually upgrade their weapons. What is the current Soviet threat? Is it an upgrade of the RPG-7? Where is the Soviet threat heading?

The answers to Mr. Bustamante's questions are classified and have been provided separately to the committee.

BMP-2

Mr. Bustamante. We are told that the new BMP-2 is equipped with a 30 mm. high velocity cannon. What effect would such fast firing cannon have on stored ammunition in the Bradley as currently configured?

Mr. Ambrose. The 30mm penetrator would cause damage to the vehicle and the crew. However, a catastrophic reaction of ammunition is not expected.

DRIVETRAIN IMPROVEMENT ON M-113

Mr. Bustamante. Is it theoretically possible to improve the engine drivetrain of the M-113 to provide similiar cross-country performance to the Bradley? If it is not possible, does that mean we must replace the M-901 ITV, the M-577 Command Post, the M-106 Mortar Carrier, the M-163 Vulcan Air Defense Gun and the M-548 tracked cargo vehicle under a combined arms operation?

Mr. Ambrose. The improvement of the M-113 drivetrain to provide similiar cross-country performance to the Bradley would require major changes to the vehicle and increased cost. We have examined this possibility in several studies as part of the decision process. Each time the answer has been that the Bradley was the most effective. The other vehicles do not have the mission of the Bradley during combined arms operations. Theoretically, the same cross-country performance would be desired in all vehicles. However, each of the vehicles listed have different functions in combined arms operation. The amount of time off road varies greatly for these support and command and control vehicles compared to the Bradley or the M-1 tanks. This allows a lesser cross-country requirement for support and command and control vehicles.

BRADLEY DESIGN

Mr. Bustamante. In the April 1985 issue of Military Technology and the February 1985 issue of Armanda International, reference is made to the Bundeswehr future plans for 1990 force development and vehicle design. The articles discuss the decision to separate the three part command responsibility of the MARDER Infantry Fighting Vehicle (20mm. Rh-202 cannon, MILAN ATGM, and infantry firing positions behind armor) into two weapons systems, the "AIFV" and the "AT combat vehicle", because the present system had "reached the limit with what a commander can cope with." Given that the German Army is reputed to be one of the most efficient in the world and that the MARDER is the precursor to our Bradley, why is the U.S. Army considering the design of the Bradley with a three part weapons system (25mm. cannon, TOW and infantry firing position behind armor)?

Mr. Ambrose. The Army has examined the possibility of taking the Bradley's three part weapon system and breaking it into different systems. The report of this effort, dated 20 March 1986 and titled "United States Army Report on the Bradley Fighting Vehicle Capability Analysis to the United States House Armed Services Committee" was provided to Congress. This classified report examined seven alternatives and found the Bradley, with a three part weapon system, to be the most effective.

M-113 and M-901 IMPROVED TOW VEHICLE COMBINATION COMPARISON

Mr. Bustamante. Please provide the Committee and my office with copies of the Army study you mentioned which compared using the M-113 and the M-901 Improved TOW Vehicle combination with just using the Bradley and which concluded that the Bradley was the better choice.

Mr. Ambrose. We will provide additional copies to the Committee and to your office.

BRADLEY, M-113, AND M-1 TANK ANTI-ARMOR PENETRATION

Mr. Bustamante. According to field manual FM-71-1 (see enclosure) armored infantry may be used to assault an enemy position at close quarters. In one of the diagrams, the field manual shows an armored infantry unit driving up to and assaulting through the enemy position. More recently at an exercise at Fort Hood, Texas, Bradleys were used to lead the assault on a woods line possibly held by opposing forces. Since this would tend to lead to a situation where the Bradley would be fired at point blank range, please answer the following questions concerning Soviet anti-armor weapons' penetration for the Bradley, the M-113, and the M-1 tank respectively.

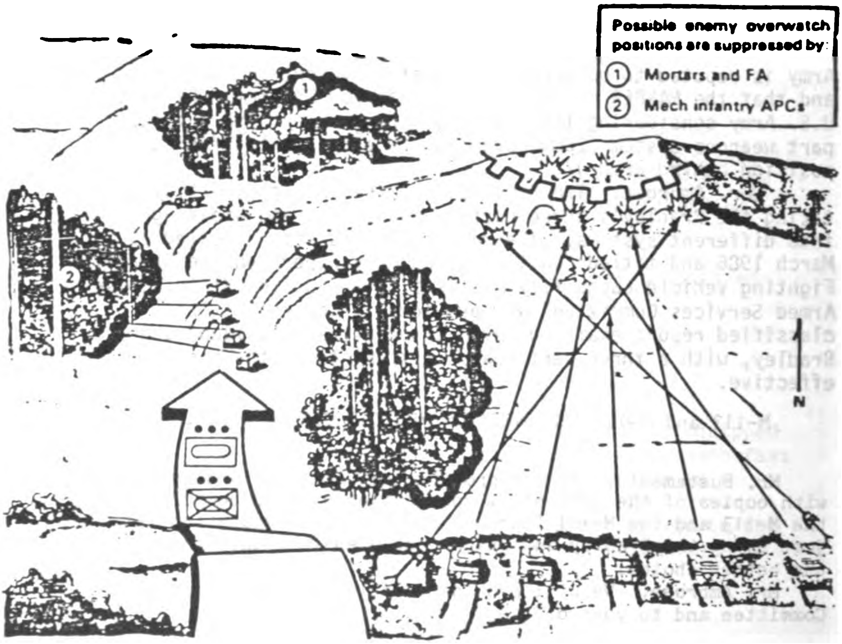
Will a Soviet 14.5 mm. heavy machine-gun penetrate any of the vehicles at ranges under 200 meters? Will it penetrate at any range?

Mr. Ambrose. M1 Armor protection for crew occupied areas ensures defeat of the 14.5mm heavy machine gun at all ranges. The Bradley specifications, which were met, requires a 95% probability of no perforation when fired [deleted] Thus, at very close ranges, there is a statistical possibility that the Bradley will be penetrated. The M113 is not designed to stop 14.5mm penetration.

## TEAM HASTY ATTACK

In developing the situation, the bounding platoon often will not be able to defeat the enemy. In that case, the team commander must immediately decide whether to ask permission to bypass or to press the attack with all team elements (for bypass, see pp 4-53 and 4-54). A hasty attack is basically developed in one of the following ways.

- **One Platoon (Tank or Infantry) Supports by Fire while Team(-) Moves to Enemy Position**




*EXAMPLE 1—One Way*

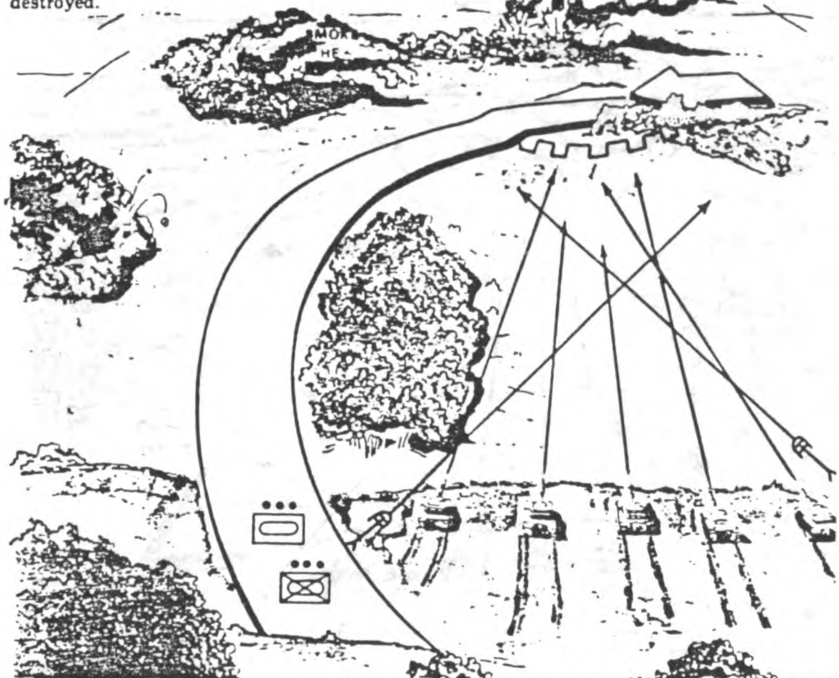
As it moves north to CP 4, a tank-heavy company team runs into an enemy force armed with AT weapons. Using the fires of the lead platoon and all other available fires to suppress the enemy, the team commander chooses a route which lets him strike the enemy flank with a tank platoon and mech platoon. The other tank platoon fires in support of the team(-) throughout most of the assault without being masked.

The enemy is in a continuous crossfire between the advancing assault elements and the supporting tank platoon. When the team reaches the objective, the infantry dismounts to clear the enemy positions from the flank.

When the maneuver teams have dismounted, the carrier teams follow the tanks across the objective. This method is used when enemy RPG fire cannot be suppressed by mounted infantry.

*EXAMPLE 2—Another Way*

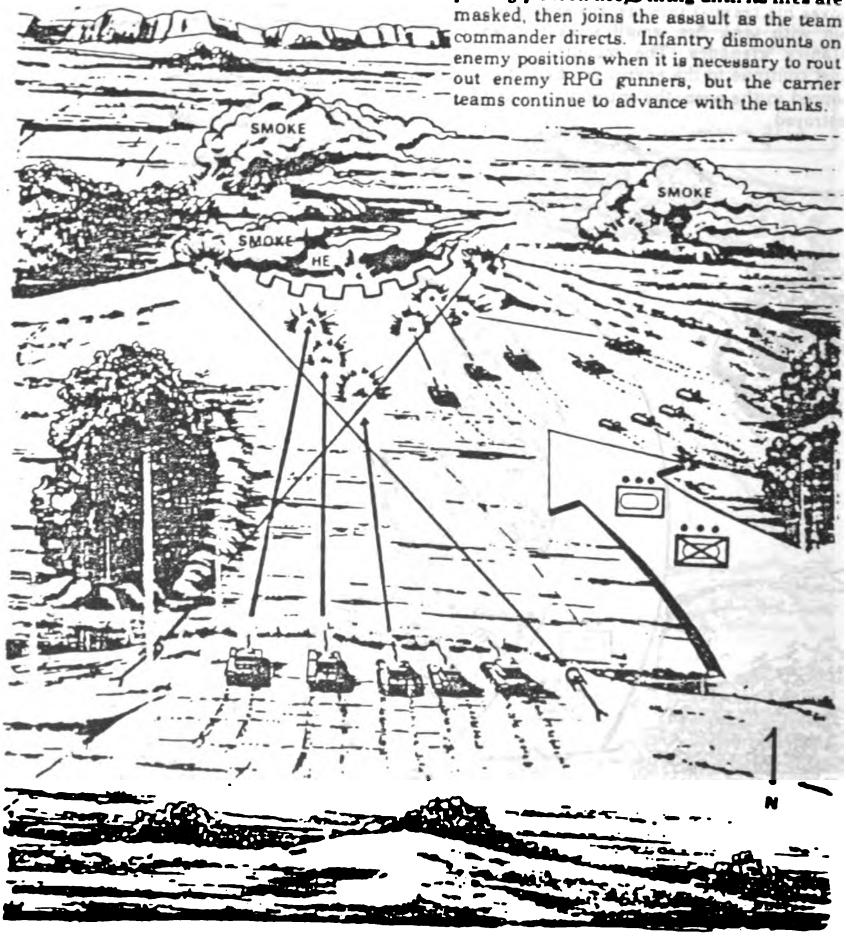
**This situation is very similar to the first example. In this case, mortar and field artillery fire (HE and smoke) suppress all possible enemy overwatch positions. The team commander, with his infantry mounted,** moves his team(-) through the enemy position with tank fire, small arms fire, and infantry grenades. The mounted assault must continue to the enemy position; if it is stopped in the open, the entire team may be destroyed.




Having reached the far side of the objective, the infantry dismounts and clears back through enemy positions. The supporting tank platoon and HAW section move rapidly to join the team(-) as soon as their fires are masked.

### *EXAMPLE 3—Yet Another Way*

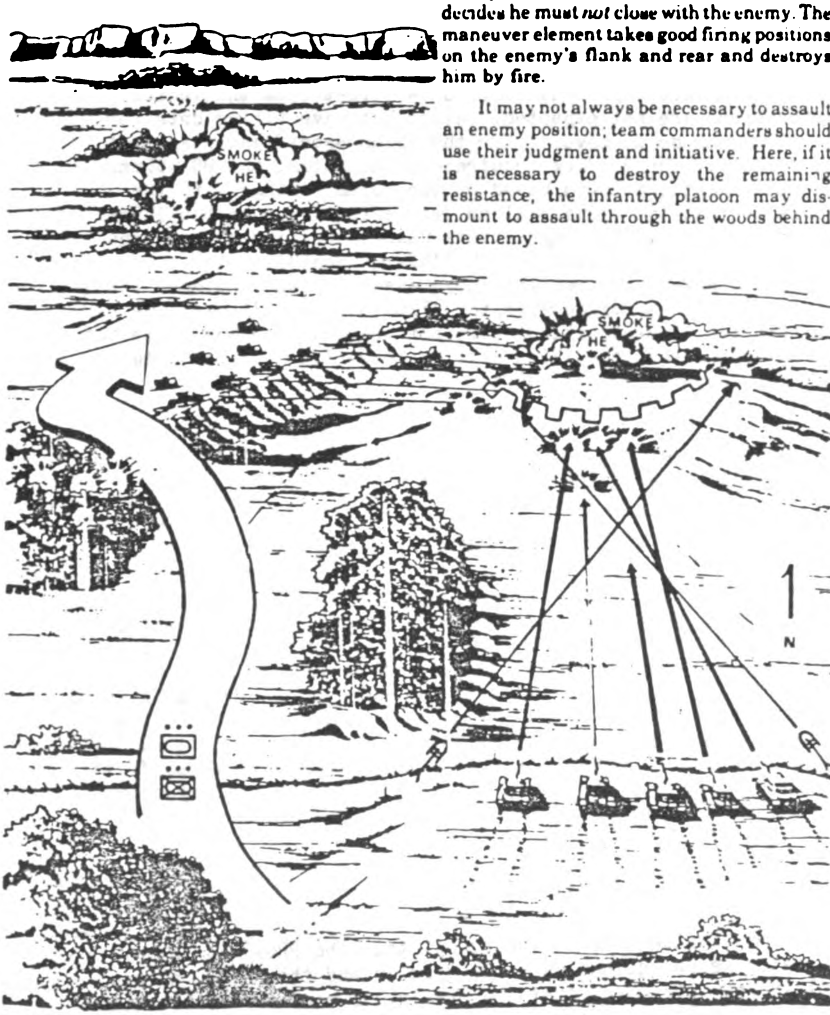
The company team has contacted an enemy force and the lead tank platoon, in overwatch, can suppress enemy fires. Because maneuver space is limited, the team must directly attack the enemy. The supporting platoon keeps firing until its fires are masked, then joins the assault as the team commander directs. Infantry dismounts on enemy positions when it is necessary to rout out enemy RPG gunners, but the carrier teams continue to advance with the tanks.



### *EXAMPLE 4—Still Another Way*

**This situation is similar to the first three examples. In this case the team commander decides he must *not* close with the enemy. The maneuver element takes good firing positions on the enemy's flank and rear and destroys him by fire.**

It may not always be necessary to assault an enemy position; team commanders should use their judgment and initiative. Here, if it is necessary to destroy the remaining resistance, the infantry platoon may dismount to assault through the woods behind the enemy.



SOVIET HOWITZER PENETRATION OF BRADLEY, M-113, AND M-1 TANK

Mr. Bustamante. At what range will a Soviet 122 mm. howitzer shell fragment penetrate any of the vehicles? At what range will a Soviet 152 mm. shell fragment penetrate the same vehicles?

Mr. Ambrose. For the 152 mm. artillery at ranges of 2 feet or less directly over the vehicle fewer than 15 perforations are expected. At ranges of 3-8 feet from the vehicle less than 5 perforations are expected. Beyond 8-10 feet from the vehicle perforations are not expected. We do not have firing data for the 122mm nor do we have it for the 152mm specifically against the Bradley. The Bradley requirement is against the US 155mm. The assessment given was based on the 155mm firings with the knowledge that the 152mm will be less effective than the 155mm against the Bradley. Computations using the fragment patterns for the 155mm projectiles and the 152mm (OF-540) Soviet projectile have borne out the above assertion and indicate the Bradley is more survivable vs the 152mm than the 155mm. The complete set of computations have not been run for the 122mm but the assertion that the 122mm will be less effective is based on such knowledge as the following:

| | 152mm | 122mm |
|---|---|---|
| Average fragment mass | 66.5 grain | 45.9 grains |
| Average fragment vel | 3370 fps | 2442 fps |

RPG-7 PENETRATION OF BRADLEY, M-113, AND M-1 TANK

Mr. Bustamante. At what range will the RPG-7 penetrate each vehicle? At what range will the RPG-16 penetrate each vehicle?

Mr. Ambrose. Because both rounds use the "shaped charge" principle to penetrate their targets, they are almost range independent. Range will primarily affect the gunner's ability to hit the target, not the ability of the round to penetrate the target given a hit. Both RPG-7 and RPG-16 can penetrate each of these vehicles in general, the greatest damage will be to M-113, the least damage to M-1 tank, with the effect on Bradley being between M-113 and the M-1 tank. The specific damage is highly dependent on shot line into the vehicle.

BRADLEY SURVIVABILITY

Mr. Bustamante. If we accept that the RPG-7 is an overmatch weapn against both the Bradley and the M-113, please explain your statement that the Bradley is more survivable than the M-113 in light of the fact that the M-113 does not carry ammunition along its walls while the Bradley carries inside ammunition for the Bushmaster gun and the TOW.

Mr. Ambrose. This is a misconception that the M-113 does not carry ammunition and fuel inside. The vehicle carries fuel, 50 cal. ammo, Dragon rounds and all of the Infantry Squad's ammunition and equipment. Overall, the Bradley has demonstrated a greater capability than either the M113 or ITV to remain functional after being hit by representative threat munitions. The major difference in the three vehicles was in catastrophic kills (K-Kill). A parallel survivability improvement program is also being pursued for M113 and ITV.

BRADLEY TRANSMISSION

Mr. Bustamante. At the hearing several references were made to the effect that the Bradley met all design specifications and requirements. Please explain why no mean miles between failure requirement was established under contract to the manufacturer of the HMP-500 transmission.

Mr. Ambrose. The development contract between GE and FMC, the prime vehicle contractor, did contain a reliability requirement of 6440 Mean Miles Between Failure (MMBF). The transmission exceeded this requirement by a wide margin during Government Operational Testing (OT) and Developmental Testing (DT). GE was a subcontractor to FMC during development as they were for the first three years of production. Our contract with FMC did not impose reliability requirements on the transmission or any other component, but instead imposed a vehicle system reliability requirement. The vehicle system also significantly exceeded this reliability requirement during developmental testing. The reasons that the FMC contract did not contain component reliability requirements are as follows:

a. The user requirement was only established at the system level.

b. It is common practice to not impose reliability requirements at a level lower than necessary, thereby allowing contractors the opportunity to optimize system design by making cost and engineering tradeoffs.

c. Lower level reliability requirements require significantly more testing to demonstrate with statistical confidence. This becomes a program cost consideration.

Recent Government production contracts directly with GE do not contain a reliability requirement because the design of the transmission has been established and the transmission is being procured using a Government controlled Technical Data Package (TDP). GE's obligation is to maintain quality of manufacture and produce a transmission in compliance with the TDP. The production contracts do contain considerable requirements to help ensure that level of quality. Examples of these quality requirements are as follows:

a. MIL-Q-9858 quality program
b. 880 Hours and 440 Hours dynamometer durability tests.
c. Product quality audits (PQA)
d. Supplemental dynamometer control tests.
e. etc.

BRADLEY WARRANTIES

Mr. Bustamante. What is the cost of the warranty for the Bradley's transmission and what reliability requirements does it cover? Are all HMPT-500 transmissions purchased by the Army covered by the warranty? If not, explain why. Please provide the Committee and my office with a copy of the warranty.

Mr Ambrose. Prior to FY83, the HMPT-500 transmission was procured as part of the end item Bradley Vehicle from the FMC Corporation. This contract provided for a "Correction of Deficiencies" clause; no warranty coverage was provided. A

warranty cost of $2,800.00 per unit is applicable to FY83, FY84, and FY85 requirements. The warranty is "failure free" in nature, and GE is liable under this warranty for all repairs for a period of one year after acceptance of the end item Bradley Vehicle.

The warranty cost for FY86 is $800.00 per unit for the 716 transmissions to support new vehicle production. The warranty will be failure free prior to integration into the vehicle at the Prime Vehicle Production Contractor. A "threshold" provision will hold GE liable for failure threshold based on current performance of recently fielded units and test transmissions. (The warranty will also include lot defect protection of non GS/Depot repairable covered items). The warranty will cover workmanship, material, redesign and essential performance characteristics. Coverage on individual transmissions does not provide for specific reliability requirements, i.e. Mean Miles Between Failure.

A copy of the warranty was provided to your office and the Committee on 6 June.

VULNERABILITY TESTING

Mr. Levine. The GAO report of February, 1986, on the Phase I Bradley testing stated that "Phase I test results do not provide a realistic picture of the vehicle's vulnerability." In fact, the test conditions the Army established--controlled shots, inert fuses, and outdated Soviet weapons--influenced the outcome of the tests in such a manner that the results indicated less vulnerability than should reasonably be expected in combat. Yet the Army's statements upon release of the Phase I results, at its December 11, 1985, press conference, seemed to indicate that all questions on vulnerability had been answered. For example, Lt. Gen. Louis Wagner stated at the press conference that:

--"They (casualties) were much less than we suspected."

--"In no case did we lose a crew, a complete crew."

--"There were some shots where we did not have any one wounded" (statement made by briefer with General Wagner).

What is the significance of those results in light of the shots being controlled? Would these statements have been true if random impact points had been used? If the shots had been fired into an area with live ammunition? In general, how can the Army have made those statements with such assurance given the conditions imposed upon the tests?

Mr. Ambrose. LTG Wagner was not trying to indicate that all vulnerability questions had been answered; or that the Army considered that sufficient live-fire testing had been done (or was ever considered feasible to accomplish) to reach such a conclusion. What he did comment on, correctly, was the actual observed results. The Army position has been, and is, that the shot lines chosen for the relatively small number of tests should be selected to yield maximum information to calibrate the computer models that are used to estimate vulnerability. Additionally, the Army viewpoint is that overmatched rounds/missiles deliberately fired into explosives will not contribute much insight other than confirmation of the estimate that a catastrophic kill will result. That estimate is already incorporated into the computer model. After the Phase II tests have been completed and the information gained from these tests has been introduced into the models, computer calculations will

then be made which will provide estimates of the BFV vulnerability before and after the fixes introduced into the Phase II test program. The statistical validity of these estimates will be limited both by the number of test shots and by the applicability of the shot pattern data gathered from past conflicts, such as the Arab-Israeli tank battles. If "random impact" shots had been fired, we have no way of telling what could have been said about the results, since we obviously do not know what the shots lines might have been. But the limited number of such shots would not allow us statistically significant statement about vulnerability no matter what results might have been obtained.

BRADLEY VULNERABILITY TESTING

Mr. Levine. Also during the December 11 press conference, General Wagner stated that:
--"Spall fragments were not significant. They will cause some casualties, but they were not a significant producer."

Yet, the GAO report, citing the DoD report, stated that:
--"(A) considerable percentage of the crew in these tests would have been wounded, most of them from spalling. The electrical system was also very vulnerable to spalling damage and...this typically caused major degradation in firepower."

How does the Army reconcile these two views of the damage caused by spalling? What changes does the Army plan to make on the M2 to limit spall damage?

General Wickham. The statements do not need to be reconciled because the context for each is different. The GAO report refers to spall damage to electrical components and casualty effects on personnel. LTG Wagner was commenting specifically on the effect of spall on stored ammunition with the potential for violent explosion. If LTG Wagner were asked about spall damage to electronics or personnel, his answer would be similar to the GAO response. The Army is planning to install spall liners in the crew area on all Bradleys beginning May 88. This will significantly decrease spall effects on the crew from overmatching rounds. The Bradley fire suppression electrical cables have been protected from spall.

PHASE II TESTING

Mr. Levine. The Phase II tests were supposed to test a reconfigured vehicle with ammunition and fuel stored on the outside, the so-called "minimum casualty baseline vehicle." In

fact, this was a major recommendation of Col. Burton after the Phase I tests. The Army agreed to this test procedure. This test has not been done to date. When the Phase II tests resume, will the minimun casualty baseline vehicle be tested side-by-side with the Bradely containing the new reactive armor? In other words, will this be a part of the Phase II test plan the Army has committed to sending Congress by June 6? Isn't such a side-by-side test essential before a final configuration decision--designed to lessen casualties--is made on the Bradley?

Mr. Ambrose. We don't yet know how to build a feasible vehicle of that sort. We have agreed with OSD to undertake an intensive design effort to see if we can come up with an operationally feasible vehicle of that sort. As soon as we can design it we will test it. Therefore, that is not included in what both Dr. Hicks and I are referring to in Phase II testing. We should not hold the rest of the testing hostage to the eventual devising and testing of that vehicle. We will do that as a further project.

REACTIVE ARMOR

Mr. Levine. The Army seems committed to the reactive armor vehicle. But what do tests of this armor show? Haven't the live-fire tests revealed substantial problems with this concept? Isn't this another example of rushing with a quick fix before the testing is completed?

Mr. Ambrose. The tests have shown the significant protective potential of reactive armor. We have identified areas where we need to make improvements before we incorporate reactive armor into production. The problems of incorporating the active armor do not appear to be major ones, but we will not incorporate such armor until any problems are fixed.

It should be understood that the generic concept of reactive armor for the BFV is one of providing attachments which will allow the reactive armor to be hung on as small plates in a field operation.

This arrangement means that the reactive armor itself can be changed as that technology evolves, independent of modifications to the BFV.

BRADLEY VULNERABILITY IN COMBAT

Mr. Levine. The Phase II testing that has already taken place has generated some controversy, especially regarding to

COL Burton's memos, that the water cans at the center of the Bradley will "greatly reduce" the vehicle's vulnerability in combat? Why were so many test shots aimed at the water cans?

Mr. Ambrose. Gunners, U.S. and Soviet, are trained to fire at the center of visible area of the target. Given the press of battle and the round to round dispersion associated with any weapon system, not all rounds hit that aim point, but nonetheless that's where they are trained to aim. For that reason, we have chosen to move ammunition as far away from the aim point as possible. Because of the limited stowage available, some items must be displaced to accommodate the ammo move. Moving the water cans makes more survivable room available for the ammo. The test shots were not aimed specifically at the water cans, but at the center of visible area because that reflects the real world training given to gunners. The significance of the water can, per se, was trivial.

COST OF SURVIVABILITY FIXES

Mr. Levine. Once the test is complete, what will be the survivability fixes? Does FMC agree? If not, why not?

Mr. Ambrose. The Army has an engineering development program ongoing for improved armor (to include reactive armor) and spall suppression liner. These improvements are scheduled to be introduced into vehicles produced beginning with the FY87 funded delivery period. A review to determine if these improvements are to be cut in is scheduled for Apr 87. Other survivability fixes, i.e., revised fuel circulation, improved fire suppression and unity vision periscope protection have been cut into production with the FY85 funded delivery period (May 86). FMC agrees this schedule is executable.

HASC Staff Inquiry Into The

Bradley Joint Live Fire Test Program



## INTRODUCTION

### A. Allegations

On April 15, 1986 Col. James G. Burton, Director of the Joint Live Fire Test Program, Office of Director of Defense Test and Evaluation, promulgated a memorandum that alleged a number of irregularities in the testing of the Bradley Fighting Vehicle as part of the Joint Live Fire Test program. Specifically, Colonel Burton charges:

1. Water cans were repositioned on the Bradley so "they were directly behind the impact point and on the shot line for shot 1." He states that "switching of ammunition and water can location changes only the test results, not the actual vulnerability in combat."

2. The Army has ignored guidance that additional Phase II shots be selected by random draw from combat hit distribution to prevent personal or systematic bias from entering the picture.

3. Specific Phase II aim points and shot lines have been intentionally selected to generate specific effects. "Eight of the planned 34 Phase II shots are aimed at the repositioned water cans." So when a round penetrates Bradley armor, it will strike water cans, thereby minimizing behind-armor damage.

4. "Since 1984 there has been a pattern of key BRL [Ballistic Research Laboratory] attempts to reduce the apparent casualties caused by the Bradley during tests...."

On April 17, 1986 that memorandum and several other documents were released during a press conference given by Members of Congress.

One of these documents also raises the issue of the Minimum Casualty Baseline Vehicle. Colonel Burton alleges the Army made a commitment to test his concept of a Bradley that stows ammunition and fuel outside the vehicle. Colonel Burton believes that crew casualties as a result of explosions and fire would be reduced with this vehicle configuration. He believes the Army is purposely delaying the test of this concept because it does not want any competition with one of its Phase II enhancements--the reactive armor concept.

As a result of the concerns expressed by members of the House Armed Services Committee, the staff was directed to conduct an investigation into the allegations described above and to examine the effectiveness of the Joint Live Fire Test Program in overseeing the Bradley tests.

B. Scope of the Investigation

The investigative team was composed of staff members representing the Subcommittees on Research and Development, Procurement, Investigations, and Seapower. The team focused its examination on the results of Phase I tests, testing methodology in the planning and execution of Phase II tests, the Office of the Secretary of Defense's (OSD) Minimum Casualty Vehicle, and the Live Fire Test Program policies and procedures as they relate to execution of the Bradley testing program. The team also conducted a preliminary inquiry into the circumstances surrounding Colonel Burton's transfer.

The investigative team interviewed officials in the Office of the Under Secretary of Defense for Research and Engineering; the Under Secretary of Defense for Acquisition and Logistics; the Under Secretary of the Army; the Deputy Under Secretary of the Army for Operations Research; officials in the Office of the Deputy Chief of Staff for Research, Development and Acquisition; the Office of the Surgeon General of the Army; the Army Materiel Command; the General Accounting Office; the Institute for Defense Analysis; and a private consultant. A list of all persons interviewed is appended to this report.

SUMMARY

A. Background

The Joint Live Fire Test Program was initiated in 1983 at a modest level with the stated purpose of testing the lethality of U.S. weapons against combat-configured Soviet vehicles and of determining (and of correcting where possible) the vulnerabilities of combat-configured U.S. vehicles to Soviet weapons. Prior to that time, the assessment of vulnerabilities was based, for the most part, on computer analysis with few full-scale test results to support the assessments.

The Army in 1983 nominated the Bradley as one of their candidates for testing. There are two versions of the vehicle--the M-3 scout (5-man) and M-2 infantry (9-man). The Army chose to test the M-3 version.

The testing program was composed of two phases.

The priority test objective for Phase I tests on the Bradley was to quantify the lethality of major caliber anti-armor munitions, often referred to as overmatching weapons (i.e., munitions capable of breaching the vehicle's armor), against the Bradley's armor. In addition, Army officials wanted to collect data to update their predictability models.

In carrying out the Phase I testing program, a building block approach was advocated and used by the Army. Testing commenced with controlled firings at

Bradley components and at production M-3 vehicles containing inert ammunition. These tests focused on individual areas of the vehicle in order to gain a better understanding of the complex interrelationships involved in modeling the effects of weapons on the Bradley and to identify improvements needed in the models used to estimate the overall vulnerability of the weapon system (based on data from selected firings). Phase I testing concluded with 10 firings at M-3 vehicles containing live ammunition. These shots addressed remaining uncertainties--the reaction of fuel and ammunition and other synergistic effects that may occur during full-up tests.

The objective of Phase II was to test the best possible means of reducing the sources of Bradley casualties revealed during the Phase I tests. In Phase II the Army specified a number of enhancements--reactive armor, spall liners, limited movement of ammunition--that would be tested. The outline test plan specified 34 total shots (17 each on 2 test vehicles), of which 14 would be repeats of Phase I shots, and 20 were to be into areas where enhancements were made.

On March 20, 1986 Phase II testing began. Primarily because of Colonel Burton's April 15 memorandum, Phase II testing was suspended on April 18, 1986, after eleven shots had been completed.

The irregularities cited by Colonel Burton are traceable to the beginning of the Bradley Live Fire Test Program. The Army and Colonel Burton have fundamental disagreements over testing methodologies and how the program should be run. Most of the issues on testing methodology raised by Colonel Burton should have been resolved by a higher decision-making level prior to initiation of the testing program. Because the issues were not resolved, the investigative team questions the adequacy of the overall policy regulating the Joint Live Fire Test program and the effectiveness of its management within the framework of developmental testing and evaluation. The team sees broader implications of the failures in the Bradley Joint Live Fire Tests for other testing program areas.

The report addresses the issue of lack of policy guidance as the overarching problem in the conduct of the Bradley Joint Live Fire Tests and then addresses the specific allegations. Because of the interrelationship among some of the allegations, more than one allegation may be discussed in the same section of the report.

## B. Findings and Conclusions

### 1. Lack of Policy Guidance for the Joint Live Fire Test Program

#### a. Analysis

No specific Department of Defense (DOD) regulations prescribing policy and procedures for the conduct of the Joint Live Fire Test program exist. Although general agreement exists on the overall goals of the program, the understanding of how the program is to be run and what the test methodology is to be varies. DOD Directive 5000.3, specified as the guidance for the tests, makes no mention of the Joint Live Fire Test program. A Detailed Test Plan submitted by the service and approved by OSD is supposed to serve as the formal procedural document for conduct of the test, but no such detailed test plan for the Phase II test of the Bradley was ever approved by OSD.

Because a Detailed Test Plan was never submitted or approved, many contentious issues regarding the test program (such as shot selection and testing methodology, and the requirement to test the Minimum Casualty Vehicle) were never resolved. Phase II tests were begun--in fact, eleven shots were conducted before the program was suspended--without a Detailed Test Plan.

To further complicate policy and procedural problems, in 1984 OSD decided that the Bradley tests would be conducted by the Army outside the framework of the Joint Live Fire Test program, and Colonel Burton was invited to participate in the planning and execution of the tests.

b. Conclusions

-- In 1984 OSD decided to remove the Bradley vulnerability test program from the OSD Joint Live Fire Test Program, for funding and schedule considerations.

-- The Army began the test program without an OSD-approved Detailed Test Plan. In the absence of an approved test plan, the Phase II tests never should have commenced.

-- Policies and procedures for the conduct of the Bradley Live Fire Test are ill-defined and not formalized.

-- The Army will not complete Phase II testing in time to report to Congress by June 1, as required by the fiscal year 1986 Department of Defense Authorization Act.

2. Allegations 1 and 3

a. The Allegations

Allegation 1. Water cans were repositioned on the Bradley so "they were directly behind the impact point and on the shot line for shot 1." He states that "switching of ammunition and water can location changes only the test results, not the actual vulnerability in combat."

Allegation 3. Specific Phase II aim points and shot lines have been intentionally selected to generate specific effects. "Eight of the planned 34 Phase II shots are aimed at the repositioned water cans." So when a round penetrates Bradley armor it will strike water cans, thereby minimizing behind-armor damage.

b. Analysis

Colonel Burton's allegations with regard to the switching of water cans and ammunition raise the issue of whether the relocation and subsequent test shot selection reflect a purposive decision by the Army to obtain test results that would make the Bradley appear less vulnerable than it actually would be in its operational mode. Fundamental to this issue is the determination of, first, whether, if rounds hit the water cans, the damage to the vehicle would be significantly less and, second, whether the expected combat distribution of hits would result in more rounds striking the water cans after the relocation.

Two days prior to beginning the Phase II tests, the location of two five-gallon water cans and ammunition boxes were switched. The two five-gallon water cans were repositioned from the left rear to the left center of the vehicle. Army officials base this repositioning on a philosophy that, to the extent possible, ammunition and fuel should be stowed away from the center mass of the vehicle because this is the target area of trained enemy gunners. A September 1984 engineering diagram for an updated version of the vehicle tested (M3A1) documents this positioning for future production versions and a "Subjective Analysis" conducted by the Ballistic Research Laboratory in July 1984 supports the Army's rationale for this decision.

No one disputes that if a round hits a water can the damage to the vehicle would be less than if a round does not hit a water can.

Colonel Burton believes very little decrease in vulnerability would be achieved as a result of repositioning the water cans. His position is supported by a study conducted by the Institute for Defense Analysis that uses combat data and that estimates only a slight increase in the probability of a hit in the water cans by relocating them to the center of the side of the vehicle.

With reference to Colonel Burton's charge that eight of 34 Phase II shots are aimed at the repositioned water cans, because no Detailed Test Plan has

been promulgated, no information is available to determine unambiguously the number of shots that may impact the water cans. The Ballistic Research Laboratory provided a diagram depicting their shot scheme which shows only two shots (one shot on each test vehicle) directly impacting the water cans. Colonel Burton bases his view on visual observation and the corresponding shot scheme shown in the outline test plan. Neither diagram is sufficiently detailed to measure impact points precisely.

c. Conclusions

-- No documentation of the decision to move the water cans immediately prior to Phase II tests to the left center side of the test vehicle was obtained by the investigative team. However, the repositioning was in accordance with 1984 Army engineering diagrams for the M3A1 and the Army stowage philosophy.

-- Independent analysis concludes that the repositioning of the water cans would have little impact on the Bradley vehicle's overall vulnerability in combat.

-- The investigative team was not able to determine with certainty the number of test shots directed at the water cans. The team concludes, however, that to remove any possibility of bias and in view of the limited number of shots, no shots should have been directed in the vicinity of the water cans, regardless of their location on the vehicle.

3. Allegation 2

a. The Allegation

The Army has ignored guidance that additional Phase II shots be selected by random draw for combat hit distribution to prevent personal or systematic bias from entering the picture.

b. Analysis

Several fundamental differences exist between the testing methodologies of the Army and Colonel Burton. The Army prefers a systematic building block approach to testing; Colonel Burton advocates immediate full-up shots of combat loaded vehicles. Also, the Army and Colonel Burton have a fundamental disagreement over whether shots should be selected at random or directed into specific areas.

Depending on the results desired, both methodologies are based on sound testing philosophies and are fully supportable if supporting data is used to fully represent the outcome. Two independent organizations, the Los Alamos National Laboratory and the Institute for Defense Analysis, have examined aspects of shot selection methodologies. Los Alamos concludes that a combination of the two methodologies be used. The Institute for Defense Analysis would prefer more randomness in shot selection but says more shots would be needed to obtain a meaningful result.

Regardless of the methodology selected, the Joint Live Fire Test Program specifies use of vulnerability lethality models as the method to evaluate prudently system vulnerability. Colonel Burton relies less on models than on random full-up shots and does not believe the Army models are good predictors. The Army believes shot selection directed to specific areas and adequate preliminary component testing prior to full-up shots should be used to update model data. The updated model is then used as the primary tool for predicting vulnerability. The Institute for Defense Analysis also concluded that the Army's overall method of selecting aim points is not representative of combat hit distribution.

These issues should have been resolved long before the initiation of Phase II testing. Because OSD had not provided formal direction on shot selection methodology to the Army and because the Army initiated the test program without an OSD-approved Detailed Test Plan, these issues were never resolved. These disputes continue today.

c. Conclusions

-- In the review of the Phase II testing, no evidence of intent to bias the test results was found. The Army's test methodology employs specific directed shots. The team observes that live fire test results reported alone do not truly represent Bradley vulnerability. Live fire test results, on the other hand, which are used to update vulnerability models, present a more realistic assessment of the vehicle's vulnerability.

-- The Army and Colonel Burton are in basic disagreement over Live Fire Testing methodology. The Army's attempts to incorporate Colonel Burton's guidance in using Combat Hit Distribution in their testing program has lead to a hybrid shot selection mothod that cannot be logically supported. The Army has concentrated all Phase II add-on shots at the center of exposed mass of the vehicle. This concentration is not representative of combat hit distributed impacts, according to an independent analysis of 1973 Arab-Israeli war data.

-- Prior to initiation of Phase II tests, no written OSD guidance was provided directing the use of random shot selection.

-- OSD guidance dated April 1, 1986 indicates that the Army's shot selection was not acceptable. Therefore, the tests should have been suspended by OSD on or about that date.

4. Allegation 4

a. The Allegation

"Since 1984 there has been a pattern of key Ballistic Research Laboratory attempts to reduce the apparent casualties caused by the Bradley during tests...."

b. Analysis

The investigative team was unable, during its investigation, to explore fully all of Colonel Burton's assertions in this area. Of those allegations investigated--shot selection methodology and interior stowage of water and ammunition and related issues--the team found that if a pattern developed, it was one of a long-standing fundamental disagreement over testing methodology and, more importantly, the inability of OSD and the Army to reach an agreement on how the test is to be conducted.

A June 14, 1984 memorandum from Colonel Burton to Deputy Under Secretary James Wade notes,

"Over the course of the past 6-8 months, Ballistic Research Laboratory has made decisions and taken actions in the conduct of this program which, when viewed as a whole, have resulted in less realism than we requested as a condition of [the Army] funding the test, less realism than was easily achievable under the circumstance, and less realism than is needed if any meaningful conclusions are to be drawn with respect to aluminum vaporifics, infantry casualties and the overall combat vulnerabilities of the M-2/3 and M-113 vehicles. In many cases Ballistic Research Laboratory's decisions and action selectively reduced the severity of the behind armor effects noticed. As a result, Ballistic Research Laboratory analyses and inferences on the meaning of the test results...will necessarily be suspect...."

Appended to the memo is a list of 18 separate actions taken by Ballistic Research Laboratory that Colonel Burton claims reduced the behind-armor effects of the test shots. These include: static detonation of weapons rather than dynamic impacts, using weapons that are too small, down-loading propellant in HEAT rounds, reducing the velocity of weapons by firing them too close, and using selected shots and angles.

On April 24, 1986 Colonel Burton provided the team with a memo that states, in part, "Over the past two years we have had numerous disagreements with the Army over the conduct of the Bradley Live Fire Vulnerability Tests and aluminum 'vaporifics' tests." The memo goes on to list 13 test-related issues that

Colonel Burton says the Army eventually agreed to and that were in accordance with the OSD direction. The majority of these issues directly resolve those areas in dispute in the June 1984 memo referred above.

Further investigation would be necessary to fully explore all other allegations of irregularities by Ballistic Research Laboratory charged by Colonel Burton.

c. Conclusions

-- The investigative team believes if a pattern developed, it is one of a long-standing fundamental disagreement over testing methodology and, more importantly, the inability of OSD and the Army to reach an agreement on how the test is to be conducted.

-- The Army has complied with many of Colonel Burton's issues of concern developed over the past several years.

5. Minimum Casualty Baseline Vehicle (MCBV)

a. Analysis

In Colonel Burton's view, the purpose of Phase II is to test the best possible means of reducing the potential casualties revealed in the Phase I test. Thus, he believes that the Army's proposed enhancements should be compared with an OSD conceptual vehicle to determine which concept produces the fewer casualties. Colonel Burton proposed a test configuration where all of the fuel and ammunition would be stored externally. The Minimum Casualty Vehicle is proposed as a test of a concept, not as a configuration for a production vehicle. Colonel Burton also believes that this concept vehicle could be available within three months of its initiation.

The Army says that it is committed to testing the concept of the Minimum Casualty Baseline Vehicle as an approach for making future modifications to the Bradley or for improving future armored vehicles. The Army, however, proposes to test the OSD configuration after the current series of Phase II tests are completed because it believes that eight monthe would be required to design and build the vehicle.

The Army's original February outline test plan says that the live fire test of the "OSD proposed vehicle configuration" would be part of a Phase IIB program after the enhancements to Army's production Bradley were tested. No specific date is mentioned.

On February 24 OSD approved the outline test plan and stated "No reports should be issued, and no production decision made on the final configuration's changes until test results from this configuration are available and compared to the test results from the configurations proposed in your Outline Test Plan." OSD understood the Minimum Casualty Vehicle would be ready for testing by May 1. When they determined it would not be ready in May, OSD recommended seeking relief from a June 1 reporting requirement to Congress until the Minimum Casualty Baseline Vehicle had been tested.

When the Army submitted its revised outline test plan on March 20, they estimated that a "technology demonstration vehicle based on the OSD concept" could be built and ready for testing in eight months. The Army advocated reporting to Congress on the baseline testing on June 1 and reporting subsequent test results on the Minimum Casualty Baseline Vehicle in February 1987.

This dispute on the length of time to build the Minimum Casualty Baseline Vehicle, when it could be tested, and how to report Phase II results to Congress has yet to be resolved.

b. Conclusions

-- The Army does not envision the Minimum Casualty Baseline Vehicle as a near-term alternative for improving the survivability of the Bradley. The

Army's preferred approach is to test the reactive armor concepts and spall liners to support a production decision in March 1987.

-- The Army has not complied with the OSD direction regarding the Minimum Casualty Vehicle. Along with the cancellation of the tests, this contributes to the Army not meeting the congressionally-mandated June 1 reporting date.

6. Colonel Burton's Transfer

On April 17, 1986 Colonel Burton submitted his retirement papers. His decision was based in large part on orders received transferring him to Wright-Patterson AFB, after having spent 16 years in the Washington, D.C. area. His transfer at a time when most routine military moves had been suspended, and his memorandum stating that he was told that he would be fired if any more "telephone calls from congressmen" were received, raise questions on the circumstances surrounding Colonel Burton's transfer.

The investigative team did not have sufficient time to conduct a comprehensive investigation into the circumstances surrounding this transfer. The facts uncovered during the preliminary inquiry would support a full investigation by the DOD Inspector General.

7. Recommendations

The committee may wish to direct that:

1. The Bradley vulnerability tests be placed back into the Joint Live Fire Test Program for administrative purposes.

2. No additional testing occur prior to approval of the Detailed Test Plan. The test plan, among other things, should resolve overall test methodology including shot selection.

3. OSD immediately undertake an effort to promulgate regulations implementing OSD guidance on the objectives and procedures for the conduct of the Joint Live Fire Test Program. Joint Live Fire policy should provide for a well-coordinated, approved testing program for the Bradley and other weapon systems programs.

4. The Army be directed to test the concept of the Minimum Casualty Vehicle.

5. No production decisions on reactive armor be made prior to the completion of the Minimum Casualty Vehicle Test and a comprehensive analysis submitted to the Congress.

6. If the concept of the Minimum Casualty Baseline Vehicle is proven as the superior method for reducing casualties, a complete review of the vehicle must be undertaken prior to any production decision.

7. The DOD Inspector General immediately investigate the proposed transfer of Colonel Burton.

8. The Phase II test report be a comprehensive analysis of the overall survivability of the Bradley with the proposed enhancements. The report is to include analytic data (vulnerability models) and the results of the actual shots taken during Phases I and II.

8. General Observations on Live Fire Test Program

1. Live Fire Testing is a useful test program to determine a weapon system's vulnerability to all types of munitions on the battlefield. This testing is useful in determining improvements to systems that might enhance survivability. This testing, however, is not designed to determine the system's ability to meet design or operational specifications.

2. Live Fire Testing should be conducted prior to full-scale production of systems. Live-fire testing should also be done prior to approval of major design modifications.

3. Live Fire Testing should be controlled and/or conducted by an independent agency -- that is, not the developer or proponent for the program.

4. The proper integration and reporting of live fire test and model results are crucial if decision-makers are to be provided with reasonable estimates of vehicle vulnerability.

## I - JOINT LIVE FIRE PROGRAM

### A. Background

The Joint Live Fire Test Program was chartered by the Office of the Under Secretary of Defense/Director, Defense Test and Evaluation in March 1984.

The program was established to examine aircraft and armored combat vehicles with the following program objectives:

1. Gather empirical data on the vulnerability of U.S. systems to foreign weapons and the lethality of U.S. weapons against foreign targets.

2. Provide insight into design changes to reduce the vulnerability and improve the lethality of U.S. weapon systems.

3. Enhance the data base available for battle damage assessment and repair.

4. Validate current vulnerability and lethality methodologies.

The priority aircraft survivability test objective is to assess air-to-ground attack aircraft including the F-16, F-15, A-6, AV-8B, AH-64, UH-60, MIG-23, and MI-24. The aircraft plan was submitted in March 1984, approved and funded.

The priority armor test objective was to determine the lethality of major caliber anti-armor munitions against first-line armored vehicles, including the T-62, M60-A3, T-72, and M-1 tanks; the M-2 (or M-3) Bradley Fighting Vehicles; and the Marine Corps Light Armored Vehicle.

### B. Bradley Fighting Vehicle

The M-3 scout (5-man) or M-2 infantry (9-man) version of the Bradley Fighting Vehicle is designed to be a highly mobile transport vehicle. The armor of the Bradley Fighting Vehicle was designed to withstand damage from the weapons of up to 14.5mm caliber. This decision was made during the development of the Bradley Fighting Vehicle based on the belief that its mobility and tactical employment would reduce its vulnerability and increase its battlefield survivability.

The employment of the Bradley requires tactical operation in an environment when anti-armor weapons capable of defeating a tank will be present. The presence of these overmatching weapons (greater than the system was designed to withstand) have resulted in extensive Army studies of Bradley survivability. These studies showed potential enhancements through changes in armor or design modifications and through improved lethality of on-board weapons.

### C. Bradley Live Fire Test Program

The Bradley live fire tests were to be conducted in two phases. The priority objective for Phase I tests was to quantify the lethality of major caliber anti-armor munitions, often referred to as overmatching weapons (i.e., capable of breaching the vehicle's armor), against the Bradley. In addition, data would be collected to update models used to predict overall vulnerability.

In carrying out the testing program, a building block approach was advocated and used by the Army. Testing began with controlled firings at a Ballistic Hull and Turret (BH&T, a vehicle with minimal internal componentry)

and production M-3 Cavalry Fighting Vehicles containing inert ammunition. These tests focused on the isolation of individual damage mechanisms and component failure modes to gain a better understanding of how to enhance Bradley survivability and to identify where the models that estimate damage required improvement.

Testing concluded with 10 firings at combat-loaded M-3s containing live ammunition. These shots addressed the remaining uncertainties that could only be assessed through full-up tests. These uncertainties involved the reaction of fuel and ammunition and any possible synergistic mechanisms that might occur in full-up tests.

The objective of Phase II was to test the best possible means of reducing the source of Bradley casualties revealed during the Phase I tests. For Phase II, the Army planned a number of enhancements--reactive armor, spall liners, limited movement of ammunition--that would be tested. The outline test plan specified 34 total shots (17 each on 2 test vehicles); 14 shots would be repeats of Phase I shots, and the additional 20 would be into areas where enhancements were made.

On March 20, 1986 Phase II testing began, and eleven shots had been completed prior to test suspension on April 18, 1986.

In 1984 the Principal Deputy Under Secretary of Defense for Research and Engineering wrote that the armor community "has been unwilling to prepare a plan consistent with the objectives of the Joint Live Fire Test Program." He complained that relatively few full-up combat-configured tests were planned and that adequate preliminary testing had already been accomplished. In May 1986 this official confirmed his position to the investigative team, stating that at the time too much reliance had been placed on computer simulation. He stated, however, that he believed many of the problems centered on such issues as the OSD directing the military services, an Air Force colonel directing Army test programs, services funding their own testing programs, and a fundamental disagreement on how tests are to be conducted.

Although the Bradley was originally part of the formal Joint Live Fire Test Program, in 1984 OSD decided that the Bradley vulnerability tests would be conducted by the Army outside the framework of from the Joint Live Fire Test Program. The Army agreed to expedite and fund the testing program. Colonel Burton was invited by the Army to <u>participate</u> in the planning and execution of the Army tests.

A fundamental difference in the approach to testing exists between Colonel Burton, who advocates immediate full-up shots, and the Army testers, who have a systematic building block approach toward testing. <u>Phase I testing was conducted, and Phase II testing begun without resolving this difference.</u>

Despite the existence of memoranda stating the goals of the Joint Live Fire Test Program, no specific DOD regulations exist prescribing policy and procedures for the program. The investigative team found general agreement on the overall goals of the program but inconsistent understanding of how the program is to be conducted and what test methodology is to be employed. Detailed test plans approved by OSD supposedly serve as the overall program guidance for such tests. In the case of the Bradley, because a detailed test plan was never approved, many aspects of the test program were never enunciated. Phase I was conducted and reported to Congress in December 1985. The goals of the Phase II program were to determine the effectiveness of proposed enhancements and to determine shock effects on fire control components. Although the test report date set by Congress is June 1, 1986, a detailed test plan has not yet been approved by OSD.

Because only one program, the Bradley, was examined, the investigative team cannot conclude, without more extensive review, whether the problems identified in this report exist in other areas of the Joint Live Fire Test Program.

<u>D. Models as Predictors of Vulnerability</u>

The initial plan for the armored combat vehicle phase of the Joint Live Fire Test Program was approved by the Joint Technical Coordinating Group for

Munitions Effectiveness in January 1985. Although this plan does not address the Bradley test program specifically, it does describe the Joint Live Fire Test Program and its relationship to overall armored combat vehicle vulnerability assessment.

The plan points out the following: In order to assess vulnerability with the greatest degree of accuracy, no substitute is available for live, full-scale testing to determine armored combat vehicle vulnerabilities. However, complexity (different hit locations, intricate and complex interiors, multiple physical phenomena); target response (a system comprising many subsystems); other constraints (lack of threat munitions); costs, etc. collectively make it difficult to acquire an adequate statistical base with which to make the assessment. To permit evaluation, therefore, testing must be conducted to provide critical input for calibrating evaluation models. These componentry models, which currently exist, are known as vulnerability lethality models. They are mathematical constructs that take into account the important interrelationships involved in the application of specific weapons against a specific vehicle and are used to estimate this effect over a wide range of circumstances based on data from a necessarily limited number of tests. The use of these models is required to evaluate prudently system vulnerability.

The plan discusses a six-step testing process as shown in figure 1. The first four steps, according to the plan, should be completed prior to conducting any live fire tests on vehicles loaded with ammunition and fuel. These include (1) characterization of the weapons and target vehicle; (2) obtaining data on effects of hits on critical components within the vehicle; (3) combining this data in the vulnerability model; and (4) calibrating the model (i.e., refining the model based on the data to improve its predictions) with tests on full-scale (minus fuel and ammunition) vehicles or surrogates. These four steps are needed to identify the areas of uncertainty and the additional information required to resolve these areas of uncertainty. Following this, full-up vehicles (step 5) can be tested to resolve the uncertainties, determine the magnitude of the expected damage, and check model predictions. Finally (step 6), with the results of the tests incorporated in the model, it can be used to assess overall system vulnerability for a variety of conditions of interest.

Colonel Burton does not believe the Army models are good predictors of vulnerability and, therefore, advocates more random full-up firings, using those results to predict Bradley vulnerability not the Army models. He cites two examples where the models did not predict actual experience: hits into fuel tanks on the M-113 in the Vietnam War and some Phase I test results for Bradley live fire tests.

The Army states that they continually update their models based on both test results and combat experience. In the two cases cited by Colonel Burton, the Army has made subsequent modifications to account for these events and now believes their models are better predictors of these events.

Many of the issues raised by Colonel Burton relate to the fundamental disagreement regarding the underlying process and the place and use of models in this process. These issues are described below.

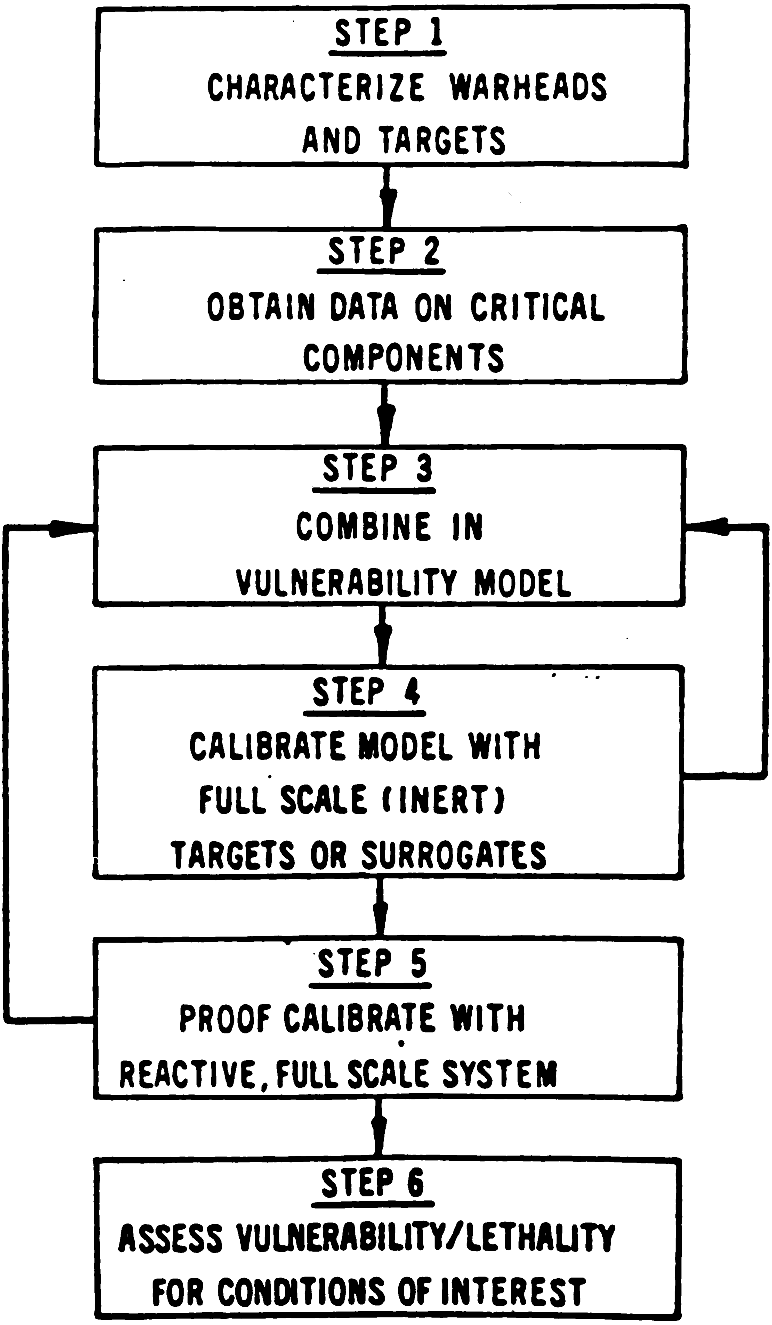



**Figure 1. Testing Process**

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## II - REPOSITIONING THE WATER CANS

### A. Chronology

Colonel Burton says that "When FMC turned over the vehicles to the Army on March 16, two 5-gallon water cans were stowed in the left rear corner of the troop compartment. On March 18 Ballistic Research Laboratory directed TECOM [Testing Command] to reposition the ammunition stowage brackets and move the water cans so that they were directly behind the impact point and on the shot line for shot 1."

The investigative team, in looking at the overarching issue--did the Army move the water cans and then direct test shots into them to bias the results--focused on two distinct questions. First, what is the intended stowage location of the water cans according to official Army doctrine, and what is the Army's philosophy for their placement? Second, were shots directed into the water cans so as to reduce the vulnerability results reported to Congress?

The Bradley is produced in several versions. The "Baseline Version" contained a built-in 10-gallon water tank located on the vehicle's right-hand side rear sponson (area above the track). Because of the difficulty in cleaning this tank the Army changed to using two portable 5-gallon water cans. A review of the Army's stowage and strapping diagram for the M3A1, dated September 12, 1984, depicts the water cans positioned in the center of the left side of the vehicle near the turret (see diagram on Ballistic Research Laboratory display of shot scheme). In March 1986, when the test vehicles arrived at Aberdeen, however, the water cans were located on the left-hand side rear sponson.

The investigative team was unable to determine the location of the water cans during the Phase I tests but assumed they were located on the left rear sponson as they were just prior to beginning Phase II tests. Army officials first became aware of this incorrect stowage on March 9 while at an FMC meeting in California. A Ballistic Research Laboratory and an Army Materiel System Analysis Agency official together reported the location to the Bradley program manager who directed that the water cans be repositioned (in accordance with the engineering drawings for the M3A1 production version of the vehicle). FMC sent a representative to Aberdeen on March 18 to direct the repositioning of the water cans. An FMC interoffice memo dated March 10, 1986 documents that 25mm ammunition was stowed "at the aim point (turret center line)" and suggested that it would be better to move the ammunition and store inert items, including water, in this area. No one was able to provide rationale for the initial stowage of the water cans.

The Army positioned its water cans based on a philosophy that, to the extent possible, ammunition and fuel should be stowed away from the center (area) mass of the vehicle because this is the target area of trained enemy gunners. This philosophy is documented in a "Subjective Analysis of the IFV/CFV [Infantry Fighting Vehicle/Cavalry Fighting Vehicle]" done by Ballistic Research Laboratory on July 19, 1984. This analysis states "The aim point on the BFVS will most likely be somewhere along the center line of the turret, regardless of whether the vehicle is in hull defilade and irrespective of the azimuth of attack. This comment on the aim point leads directly to the first point of discussion for the ammunition stowage; specifically, do not stow ammunition around the center of the vehicle."

Colonel Burton supports his position with statistics that are interpreted to show that hits occurring in combat are distributed over the entire vehicle and are not concentrated on the center mass of the lateral side of the vehicle. Thus, in Colonel Burton's view, placing the water cans near the center of the vehicle will not necessarily reduce the vulnerability. Colonel Burton further asserts that switching of the water cans and ammunition in Phase II was accomplished in order to reduce apparent casualties and was a deliberate attempt by Ballistic Research Laboratory to bias the test.

The investigative team did determine that the Ballistic Research Laboratory and Army Materiel System Analysis Agency officials who reported the location of the water cans were also the officials directly involved in selecting the

Phase II non-repeat aim points. The Ballistic Research Laboratory and Army Materiel System Analysis Agency officials testified that they did not consider shot selection when they suggested the repositioning of the water cans, nor did they consider the new position of the water cans when they redrew the shot lines. They stated that they believed it was a coincidence that an added shot impacts the water cans.

On the question of the location of the shot lines in the test, Colonel Burton says "Eight of the planned 34 Phase II shots are aimed at the repositioned water cans." [Because 17 shots were planned for each vehicle (a total of 34 shots), this would mean 4 shots on each vehicle could strike the water cans.] Colonel Burton's position is based on a visual examination of the test vehicle and the shot scheme represented in the outline test plan that depicted shots impacting the center area of the vehicle. A detailed test plan, however, was not available.

The Army's detailed test plan, as of this writing, is still in draft form, so no official shot plan has been submitted by the Army to OSD for approval. Ballistic Research Laboratory, however, prepared diagrams representing the shot lines according to their analysis. These diagrams show that one shot, shot #5 (a Rocket Propelled Grenade [RPG]), on each vehicle would penetrate the water can directly and another RPG shot (#1) on each vehicle might strike the cans but would first have to travel through a box of 25mm ammunition (see diagrams). The investigative team found that one additional RPG round's shot line (#6), not included on the diagram, could impact on right-hand side of the vehicle, penetrate through the vehicle, and hit the water can.

The draft detailed outline test plan states "Every attempt was made to select impact points that would test vehicle design and to determine the behind-armor effects on the vehicle. No attempt was made to exclude catastrophic shots. In fact, all of the shots have fuel, ammunition, personnel, or critical components on the shot line".

The investigative team found this not to be the case. It is clear that while all eight shots identified by Colonel Burton probably would not penetrate the water can, anywhere from two to six of the shot lines may intersect the water cans. Most Army witnesses stated that attempts were made to avoid catastrophic shots; that is, shots that were known to cause extensive damage. The investigation revealed that not all of the shots had fuel, ammunition, personnel, or critical components on the shot line. A shot into a water can does not necessarily have these items behind them.

The Army, however, defends its shot plan by saying that because the RPG rounds were not expected to penetrate the enhanced armor, it really does not matter what is behind the armor.

B. Effects

Colonel Burton says "...that the switching of ammunition and water can locations changes only the test results, not the actual vulnerability in combat. This is because:

a. The exposed area of ammunition has not been decreased.

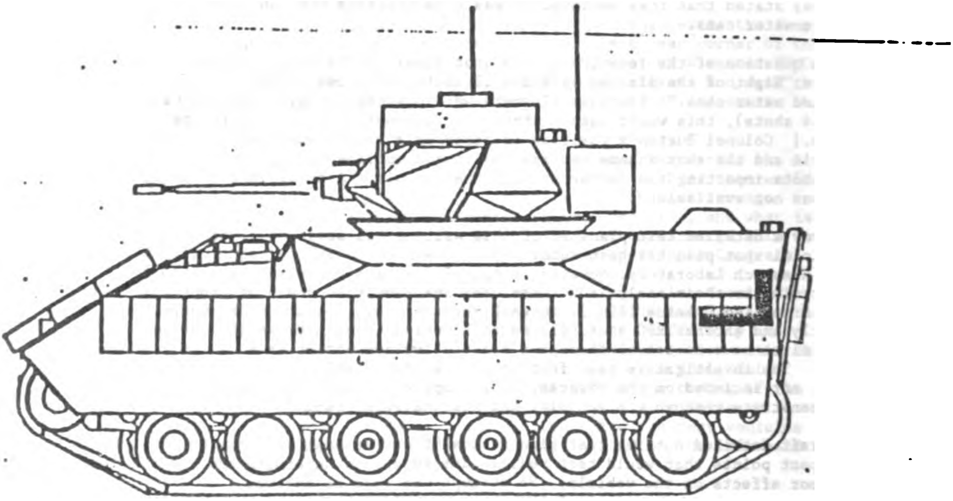
b. The actual density of hits, based upon real combat results, is essentially the same for the old and new position of the relocated ammunition."

An Army issue paper (unsigned) stated in response to this statement:

"False; data shows that density of hits are based on location of the aim-point. The restowage move(d) the ammunition to the rear of the vehicle. The probability of a hit on the relocated ammunition is greatly reduced."

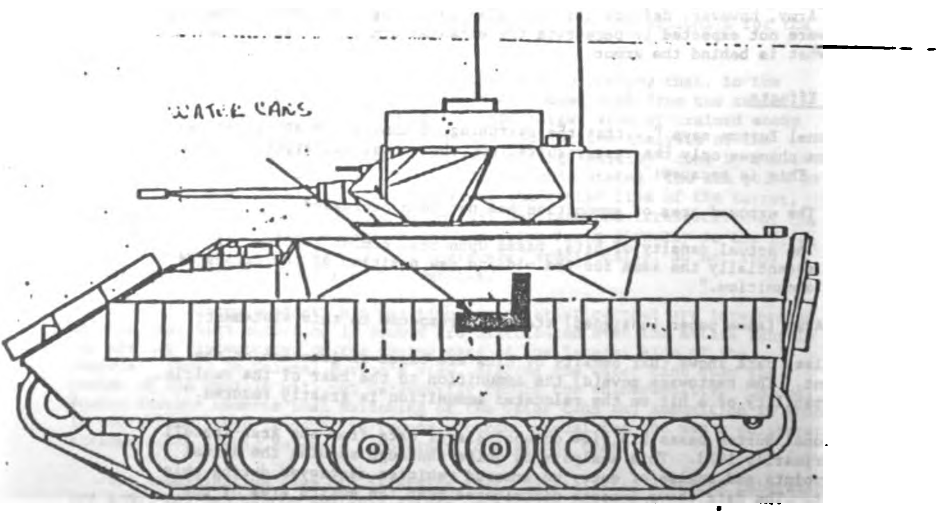
Colonel Burton bases his view on analysis of data from the Arab-Israeli wars, primarily 1973. This analysis is quite thorough showing the actual impact points and angles of entry on armored vehicles destroyed during this conflict. The data shows impacts distributed over the entire area of the

DIAGRAM PROVIDED BY COLONEL BURTON (#1)



BASED UPON COMBAT HIT DISTRIBUTION, 99.3% OF SHOTS WOULD MISS THE WATER CANS -- LOCATED IN THIS ORIGINAL POSITION.

DIAGRAM PRESENTED BY COLONEL BURTON (#2)




BASED UPON COMBAT HIT DISTRIBUTION, 98.7% OF SHOTS WOULD MISS THE WATER CANS LOCATED IN THE NEW LOCATION.

vehicle. Colonel Burton presented a recent analysis by the Institute for Defense Analysis using this data, to determine what the probability of a hit would be on water cans located in the center of the vehicle versus water cans located in the rear of the vehicle. The analysis shows that there would be only a slight reduction in the probability of a hit striking ammunition. (See attached diagrams).

Army witnesses stated that armored vehicles in combat will experience a higher concentration of hits near the center of exposed mass of the vehicle and, for higher caliber weapons, concentrations will also be in the forward area of the vehicle. The Army view is based on interpretations from both combat and test range data (including the 1973 war, World War II, Viet Nam and developmental and operational weapons tests). Army witnesses stated they would not rely on any one study of combat data because all data is scenario dependent and not necessarily representative of a European conflict.

All of the non-repeat shotlines added by the Ballistic Research Laboratory in the Phase II test pass through the center of the vehicle. Army witnesses explained that U.S. and Soviet gunners are trained to aim at the exposed center of mass of a vehicle. Thus for each angle chosen by their method, they overlaid on the center of the Bradley a one standard deviation ellipse representing peacetime test range data on expected weapons dispersions. Army witnesses stated that the majority--68 percent-- of the shots in combat would fall within this area. Ballistic Research Laboratory then picked the exact impact point for the test shot somewhere within this area. With this method, the Army, Balistic Research Labora- tory, and Army Materiel System Analysis Agency witnesses explained why the test shots are concentrated at the center of the vehicle, and why moving the water cans to the center would reduce the vulnerability of the vehicle.

Analysis of this method done for Colonel Burton by Institute for Defense Analysis points out several problems.

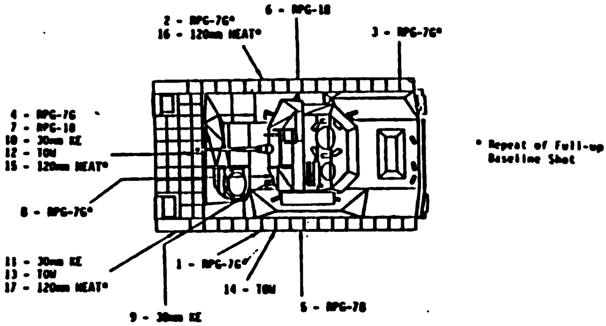
Firstly, Institute for Defense Analysis concludes that the Army analysts made a common statistical error that results in overstating the number of shots that would fall within a one standard deviation ellipse around the aim point. Institute for Defense Analysis analysts told the investigating team that this ellipse is a bivariate normal distribution and would only represent hits by 39 percent of all shots, not 68 percent. Recent discussion with Army analysts indicate they agree with Institute for Defense Analysis on this figure.

Secondly, Institute for Defense Analysis also calculated actual combat hits within this ellipse for one class of weapons and found that only 29 percent of the combat hits were within the ellipse. The Institute for Defense Analysis used combat data relied upon by both the Army and Colonel Burton.

The evidence reviewed by the investigative team supports the statement that the actual density of hits based upon real combat results is essentially the same for the old and new position of the relocated ammunition and water cans. Although the movement of the water cans to the center may not be wrong in itself, the actual impact of this move on the vehicle's vulnerability is small and should not be overstated.

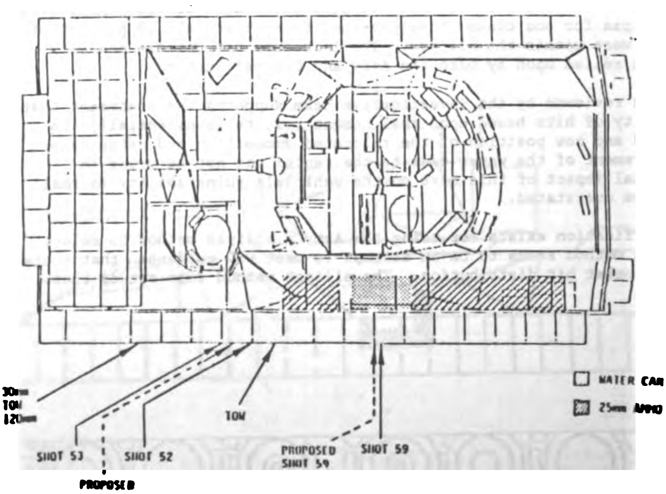
Little justification exists for using the Army's ellipse method to select aim points. The method seems to be an attempt to meet OSD guidance that shots be selected on combat hit distribution. The ellipse method does not do that.

## PHASE IIA - ENHANCED VEHICLE FIRINGS




- SHOTS 8 AND 9 AGAINST HULL DEFILADE TARGET; REMAINING SHOTS FULLY EXPOSED TARGET (ISU TO BE REMOVED FOR SHOT 8)
- SERIES TERMINATED IF VEHICLE IS DESTROYED OR NO LONGER USABLE AS A TARGET
- FULL SUITE OF RAFAEL ARMOR WILL NOT BE AVAILABLE FOR ALL SHOTS; SUFFICIENT TILES WILL BE AVAILABLE TO COVER EFFECTS AREA
- TEST SETUP, PROCEDURES, AND INSTRUMENTATION SAME AS PHASE I TEST

BRL, RAFAEL
(BRL ARMOR SHARM)



## III - SHOT SELECTION

Colonel Burton says that "Congressional, GAO, USDRE criticism about controlled aim points during Phase I led USDRE/TE to direct on April 1 that the additional Phase II shots be selected by random draw from combat hit distribution to prevent personal or systematic bias from entering the picture. The Army has ignored this guidance."

In examining this allegation, the investigative team focused on three questions: (1) What are the objectives of the Phase II test?; (2) What is the basis for the shot selection criteria?; (3) What is the actual guidance from OSD regarding shot selection?

### A. Objectives for Phase II Test

Both the Army and Colonel Burton agree that the purpose of the Phase II test is to determine the effectiveness of several proposed survivability enhancements for the Bradley. In Phase I, all of the 10 shots fired at fully loaded Bradley vehicles were specifically selected to fill voids in the Army's computer models. Phase II consists of 17 live-fire shots against a fully-loaded vehicle. Seven of the 17 shots were to be repeats of Phase I shots where enhancements have been proposed. The selection of the additional 10 shots is in contention.

The Army believes that, due to the limited number of shots, a true statistical combat representation is not possible. Thus, their approach is to update their combat vulnerability models through live-fire testing and use the models to predict the contribution of the proposed enhancements.

Colonel Burton agrees that the number of shots is limited but believes that the live-fire tests provide significant data because the Army models are not accurate predictors. Colonel Burton believes that the results of the Phase I test (that is, the lack of correlation of predicted values with actual values of reported shots) support his position that the Army's models are not valid predictors.

Based on these differences, the Army and Colonel Burton disagree on the methodology for shot selection of the 10 additional shots. These differences represent two different approaches to testing weapon systems that have persisted throughout the Bradley test program. In Phase I, OSD ultimately agreed to proceed with the Army's methodology for selecting the shots.

### B. Criteria for Shot Selection

Colonel Burton's position is that to avoid any perception of bias, shots should be selected randomly. As such, shots would be selected by random draw from a distribution derived from the 1973 Arab-Israeli war, Vietnam and World War II. Once selected randomly, proposed shots would be discarded if they did not hit areas on the vehicle where enhancements were to be made. Further, if all agreed that a particular shot would be a catastrophic kill, those shots could be discarded if the final report denoted these shots as a catastrophic event.

Because of criticism of bias in the shot selection in Phase I, the Army decided to modify its approach for Phase II. For Phase II, the Army's objectives for shot selection were to determine the contribution of proposed enhancements to the Bradley. The Army's approach was to select shots that could be matched with areas of proposed enhancements as well as adequately represent attack angles that correspond to the highest proportion of expected combat impact locations derived from war data (the Army's data base includes Vietnam, 1973 Arab-Israeli War, World War II). The Army defined aim points based on the center of mass of the vehicle presented at each attack angle. The actual impact points were then selected from within one standard deviation of the chosen aim point in order to provide for the inherent inaccuracy of the weapons being fired. (The notion of accuracy based on one standard deviation around the aim point is derived from Army peacetime training data).

Analysis of this approach by the Institute of Defense Analysis shows that selection of aim points based on the center of mass and one standard deviation does not represent combat distribution data.

At the request of the Army, an independent assessment of both general approaches was prepared by the Los Alamos National Laboratory. The two approaches were characterized as random aim point selection (Colonel Burton) and deterministic aim point selection (Army). The Los Alamos assessment concludes that both test design approaches are widely used in scientific endeavors, and that both have strengths and weaknesses. The Los Alamos report recommends that a combination of the two approaches appears to be the best solution. Further, they recommend that test results need to be reported along with appropriate modeling results in order to avoid misinterpretation.

C. GAO Report

In its report reviewing Phase I, the GAO states that "Test conditions influenced the test results making the vehicle seem less vulnerable and the casualty rate lower than might actually be the case under combat conditions. Most of the 10 live-fire test shots were aimed to deliberately avoid striking the explosive elements of the stored ammunition. According to the Army, this was because the effect of such shots--total loss of the vehicle and the entire crew--was already well known....Had shots reflecting the combat distribution of hits been fired, the vehicle loss rate and estimated crew casualty rate might have been much higher."

The GAO staff explained that, in their view, the Army's approach to the shot selection was legitimate given that the Army includes in the final report a discussion of the effects of those shots that were excluded--firing shots into fuel and ammunition.

The GAO also states that "The Army used the Phase I test results to update its vulnerability models which predict the Vehicle's vulnerability in combat, but only a limited amount of the updated vulnerability information obtained from the models was used in preparing the report submitted to Congress...This data would have helped to provide a more realistic assessment of the Bradley's vulnerability."

In a letter to the GAO dated April 24, 1986, OSD replied to the GAO report, stating that "The Phase I tests, however, were not intended to produce complete vulnerability estimates. Complete vulnerability assessments will not be available until after Phase II tests." The letter further states, "The Phase II tests on the Bradley will be conducted similarly to Phase I, but are designed to collect data about the vehicle with survivability enhancements added to it. Data from both phases of the Bradley tests will then be fed into the vulnerability models and weighted by a combat distribution to estimate the casualties that would be experienced in combat situations."

D. Documentation of DOD Guidance

The Army submitted its first outline test plan to OSD on February 18, 1986. Although the first outline test plan generally identifies the proposed Phase II shots, it does not address the rationale behind the shot selection. On February 24, 1986, Under Secretary Hicks approved the outline plan subject to five conditions. The OSD approval does not discuss the shot selection scheme.

On March 20, 1986, the Army submitted a second outline test plan in response to the issues raised by Dr. Hicks' memo as well as those raised during informal discussions with the OSD staff. The March outline test plan provides a modified shot plan and identifies the Army's proposed shot selection criteria. The March 20th outline test plan clearly states that the tests would begin on March 20th. The Army notes that the first three shots--scheduled to be fired by March 27th-- would be duplicates of Phase I shots.

On April 1, in response to the March outline test plan, the Deputy Under Secretary of Defense for Test and Evaluation sent a memo to the Deputy Under Secretary of the Army for Operations Research. The April 1 memo provided the following guidance: "The shots planned for Phase II should either repeat the aim points from Phase I where improvements have been made on the vehicle or be

selected at random from combat hit distributions in a manner similar to that recently completed by your M1A1 test planning team."

Firings against the Bradley began on March 20, 1986. The first four shots fired were repeats of Phase I shots. During the week of April 1st, two shots that did not repeat Phase I shots were fired at the Bradley vehicles. (The first shot occurred on April 1 and the second shot on April 2.)

The testimony provided by officials in OSD indicates that although the written guidance could have been interpreted as ambiguous, several conversations ensued between OSD and Army officials to clarify that the Army was directed to select shots at random from the combat hit distribution data, for those non-Phase I shots.

Testimony received from Army officials indicates that the guidance was ambiguous. Thus, the Army assumed that they had received approval to proceed with their preferred shot selection approach. Army witnesses state that the Deputy Under Secretary of Defense for Test and Evaluation did not discuss this issue with the Army until April 18, 1986.

At this time, the conflict concerning the shot selection scheme apparently has not yet been resolved.

## IV - PATTERN OF IMPROPER BEHAVIOR

Colonel Burton said, "Since 1984 there has been a pattern of key BRL [Ballistic Research Laboratory] attempt to reduce the apparent casualties caused by the Bradley during tests, including:

"a. Watering the dummy uniforms in 1984.

"b. Selecting the 5-man M-3 configuration to test in 1985 instead of the 9-man M-2.

"c. Using selected instead of random aim points during Phase I.

"d. Switching water can and ammunition in Phase II."

The investigative team was unable during this investigation to explore fully all of Colonel Burton's assertions in this area. Of those allegations investigated--shot selection methodology and interior stowage of water and ammunition and related issues--the team found that if a pattern developed, it was one of a long-standing fundamental disagreement over testing methodology and, more importantly, the inability of OSD and the Army to reach an agreement on how the test is to be conducted.

A June 14, 1984 memorandum from Colonel Burton to Deputy Under Secretary James Wade notes,

"Over the course of the past 6-8 months, the Ballistic Research Laboratory has made decisions and taken actions in the conduct of this program which, when viewed as a whole, have resulted in less realism than we requested as a condition of [the Army] funding the test, less realism than was easily achievable under the circumstance, and less realism than is needed if any meaningful conclusions are to be drawn with respect to aluminum vaporifics, infantry casualties andthe overall combat vulnerabilities of the M-2/3 and M-113 vehicles. In many cases Ballistic Research Laboratory's decisions and action selectively reduced the severity of the behind armor effects noticed. As a result, Ballistic Research Laboratory analyses and inferences on the meaning of the test results...will necessarily be suspect...."

Appended to the memo is a list of 18 separate actions taken by Ballistic Research Laboratory that Colonel Burton claims reduced the behind-armor effects of the test shots. These include: static detonation of weapons rather than dynamic impacts, using weapons that are too small, down-loading propellant in HEAT rounds, reducing the velocity of weapons by firing them too close, and using selected shots and angles.

On April 24, 1986 Colonel Burton provided the team with a memo that states, in part, "Over the past two years we have had numerous disagreements with the Army over the conduct of the Bradley Live Fire Vulnerability Tests and aluminum 'vaporifics' tests." The memo goes on to list 13 test-related issues that Colonel Burton says the Army eventually agreed to and that were in accordance with the OSD direction. The majority of these issues directly resolve those areas in dispute in the June 1984 memo referenced above.

Further investigation would be necessary to fully explore all other allegations of irregularities by Ballistic Research Laboratory charged by Colonel Burton.

## V - MINIMUM CASUALTY BASELINE VEHICLE

In an April 8, 1986 memo for The Record, Colonel Burton says "Two months ago the Army agreed in principle to test a third vehicle, one with all fuel and ammunition removed from the troop compartment and stored either externally, or in externally vented compartments....The Army informed us that the vehicle will not be ready for test until November, and test results won't be available until February 1987....It was made clear in this meeting that the Army does not want any competition with their reactive armor concept. They have made up their minds before all test results are in."

In examining this allegation, the investigative team focused on two questions: (1) What is the nature of the Army's commitment to test the Minimum Casualty Vehicle; (2) What is the OSD direction regarding testing of this vehicle, and incorporation of test results into production decisions for future enhancements to the Bradley?

In Colonel Burton's view, the purpose of Phase II is to test the best possible means of reducing the sources of casualties revealed in the Phase I test. Thus, he believes that the Army's proposed enhancements should be compared with a baseline vehicle to determine which concept produces the fewer casualties. Because fuel and ammunition stored inside the vehicle produce greater casualties, Colonel Burton proposed a test configuration where all of the fuel and ammunition would be stored externally. Colonel Burton proposed the Minimum Casualty Vehicle as a test of a concept, not as a configuration for a production vehicle.

Colonel Burton believes that this concept vehicle could be made available in three months of its initiation. His estimate is based on conversation with the Project Manager for the Bradley vehicle and with technicians at Aberdeen Proving Grounds. The Project Manager disagrees with Colonel Burton's estimate and states that his original estimate of three months was not based on the current description of the Minimum Casualty Vehicle.

The Army says that it is committed to testing the concept of the Minimum Casualty Baseline Vehicle as an approach for making future modifications to the Bradley beyond the current 6,882 vehicle program or for improving future armored vehicles. A memo from Commander, Army Material Command states that "The current development program for the addition of reactive armor to the Bradley has potential for high payoff and we should not slow down this development effort because of the OSD proposed design. The production decision is scheduled for March 1987, after the testing of the OSD vehicle could occur if we move out now [sic]."

The Army proposes to test the OSD configuration after the current series of Phase II tests are completed because it believes that eight months will be required to design and build the vehicle.

The Army's rationale for an eight-month design and development period is that: (1) several operational problems (such as access to the ammunition by troops located inside the vehicle) need to be resolved before a vehicle is fabricated for testing; (2) the test vehicle needs to be one that is ready for production if it proves to be the best solution for reducing casualties.

The OSD direction to the Army regarding the Minimum Casualty Vehicle is clear. On February 24, 1986, the Under Secretary of Defense for Research and Engineering directed that "No reports should be issued and no production decisions made on final configuration changes until test results from this configuration are available and compared to the test results from the configurations proposed in your Outline Test Plan."

Throughout the discussions between the Army and OSD regarding the Minimum Casualty Vehicle, the Army has been concerned that the fiscal year 1986 Department of Defense Authorization Act requires that the final Phase II test report to Congress must be provided by June 1, 1986. Thus, the Army has argued that the two tests be decoupled and that a report be submitted covering only the test results of the Army's proposed enhancements.

The direction from OSD is clear on the testing of the Minimum Casualty Vehicle and its effect on the required report to Congress. On February 24, 1986, OSD directed that "if it is necessary to seek relief from Congress on the June test report requirement to accomodate (sic) these results and comparisons, then we will initiate that action."

Based on the testimony received by the investigative team, the conflict over this issue has not yet been resolved, notwithstanding previous OSD direction. The Under Secretary of the Army apparently intends to request that the Under Secretary of Defense reconsider the previous position. This would represent the second official appeal of the OSD direction.

## ADDITIONAL VIEWS

The investigation team agrees on the recommendations in the report. However, there is some disagreement over the text of the report and the conclusions.

It may not be clear from the report that the evidence examined by the team substantially supports four of the five key statements in Colonel Burton's memos. That is:

1) The switching of the ammunition and water can location does not significantly change the vehicle's vulnerability in combat, but it could change the test results;

2) The Army did ignore the April 1 OSD guidance that additional Phase II shots be selected by random draw from combat hit distribution;

3) From two to six of the planned 34 Phase II shots are aimed at the repositioned water cans. (It is possible that eight are aimed at the cans, but the team could not verify that.)

4) The team could not prove or disprove a pattern of key BRL attempts to reduce the apparent casualties in the Bradley tests.

5) The evidence supports Colonel Burton's claim that "the Army does not want any competition with their reactive armor concept. They have already made up their minds before the test results are in." General Thompson's words from 17 March 1986 are "..we should not slow down this [reactive armor] development effort because of the OSD proposed design." Yet, the full-up, live-fire tests have revealed substantially problems with

the BRL reactive armor design. The BRL's component testing--using static detonations fixed to the armor--did not predict these problems.

**Was There Bias?**

The report concludes that "... no evidence of intent to bias the test results was found." While the team has no proof of bias, there is evidence which raises questions about the impartiality of the shot selection scheme. While those involved seemed well-intentioned, the way these tests were conducted seems inconsistent with objective testing. Four examples of that evidence follow.

(A) The two Army officials in charge of selecting aim points for Phase I are the officials who suggested moving the water cans and then redrew the test plan to include a shot directly into the cans.

- The two officials met with several Army officers and with FMC officials to discuss the Phase II test on March 9, 1986 at FMC headquarters in San Jose, CA.
- During the meetings the officials suggested repositioning the water cans.
- During the week of March 10, the officials met again. They again discussed the repositioning of the water cans. In response to criticism of their shot selection method, they redrew the shot lines for the Phase II tests. They added shot #5 which has an impact point in the center of the repositioned water cans.
- . On March 18 an FMC official repositioned the water cans on the test vehicles at Aberdeen with the assitance of Test Command (TECOM) technicians.
- . On March 20 the first test shot was fired. In all, three of the shots fired had shotlines which intersect the water cans.

As the report notes, these officials believe it is a coincidence that shot #5 impacts at the center of the water cans.

(B) The team found no evidence that the repositioning of the water cans was included in the enhancements proposed by the Army for the test vehicles in Phase II.

Nor is the repositioning of the water cans discussed in any memos about the Phase II tests (including a detailed Army memo summarizing the March 9 meeting at FMC) until immediately before the move was made. Nor was the repositioning mentioned to Colonel Burton when he visited FMC on March 11. While such documentation may exist, none was provided the team despite repeated requests.

As the report notes, we do have a 1984 memo and diagrams that indicate Army plans to reposition the water cans on future M3 Calvary Fighting Vehicles. The diagrams do not show this change for M2 Infantry Fighting Vehicles.

It is not clear how this production change relates to the test vehicles. It does not appear to be part of the test package. When FMC completed its three weeks of modifications to the test vehicles, the water cans were in the left rear.

(C) Even so, moving the water cans would not be a significant event if so many shotlines did not intersect the area.

The team report concludes (1) that moving the water cans does not reduce vehicle vulnerability and (2) that the BRL method for selecting shots for Phase II is not valid. How then, does one explain the shot selection? The testimony of four sets of independent experts ranged from bemusement to suspicion. All were concerned about the number of shots directed at the center.

The report should more clearly explain that BRL method results in more shots at the water cans than can be justified by combat data. IDA's data show that in combat 1 out of 100 RPG's fired from the left would hit the water cans (1.3%). In the BRL test at least 1 out of 2 RPG's fired from the left would directly hit the water cans (50%). Both RPG's (100%) have shotlines which intersect the water cans.

IDA analysts told the investigation team that if these shots at the water cans were to be taken as representative of combat hits, it would create a misleading impression of the vehicle's vulnerability.

(D) The Los Alamos report states that the BRL approach may introduce biases into the estimation of kill probabilities.

"The BRL objective of assessing vulnerability," the Los Alamos team says, "does not lead directly to any criteria of where to locate the shots...we conclude that the modeling approach offers little guidance in choosing aim points and that the selection criteria are difficult to explain to critics." Further, "it is possible, using this approach, for unsuspected or rare events or combinations of events to go undetected because test design may preclude their discovery."

On the other hand, the random shot approach will provide "an unbiased estimate of kill probabilites," and "the existence and consequences of unanticipated vulnerabilities have a chance of being demonstrated dramatically in full scale tests." The disadvantage of random shots is that one cannot extrapolate to a more general model with precision. If avoiding biases is the goal, then the random shot approach would seem to be preferable over the BRL method.

## Was the Transfer of Col. Burton Retaliatory?

The transfer of Col. Burton does not appear to be routine. Further Congressional investigation is warranted to assess the propriety of the transfer and its wider implications.

1.) The transfer at this time is almost certainly to have a chilling effect on others in DoD who question the effectiveness of institutional procedures, particularly in the testing field. It is comparable to the transfer of the rocket engineers who tried to stop the disastrous launch of the space shuttle Challenger.

2.) Colonel Burton obeyed military orders which assigned him to various posts in the Washington area over the past 16 years. It is not clear how this compares with other officers in his field or his department. While this situation may have required adjustment, the timing of the transfer and the exemption from the freeze on transfers are suspect, particularly in light of other events preceeding the transfer.

• In a Memorandum for the Record dated 22 December 1985, Col. Burton states that he met with the Under Secretary for Research and Development in his office a few hours before Burton was to meet with members of the House Armed Services Procurement Subcommittee. The Secretary, according to Col Burton, "...told me that writing independent reports on test results may have been my job in the past, but from now on I was not to write anymore 'independent' reports....Dr. Hicks then advised me that if he ever received anymore telephone calls from Congressmen about me, that I would be fired."

If this is accurate, then the Secretary may have violated Federal laws protecting an employee's right to disclose information to Congress.

Col. Burton's supervisor at the time was present at the meeting in the Secretary's office. He testified that the meeting got "heated," but denies that the Secretary threatened to fire Col. Burton.

• Col. Burton also states that "Following the Hick's meeting I returned immediately to my office where I passed on to my office colleagues Dr. Hick's accusations and directions." Gen. Jones, Col Burton's immediate superior was present at that time. Further investigations should verify the accuracy of these incidents and question why Col. Burton's superior's, once informed of the situation, did not seek compliance with and enforcement of the applicable laws and regulations as required by law.

3) Col. Burton was not officially informed of the possibility that he might be allowed to stay in charge of the Bradley test program if he accepted the transfer until 15 minutes after the deadline had passed for him to either accept the transfer or resign. This is confirmed by Col. Burton's two superiors, including the official who actually handed Col. Burton the written offer.

Thus, official DOD statements in letters to Members of Congress that Col. Burton was notified of this possibility on April 7, and that Col. Burton's resignation "preempted" this possibility appear not to be correct.

## Is There A Pattern? Is There a Policy?

The water can incident must be judged in the context of the conflict between the BRL test methods and the JLFT program attempts to test in a more realistic manner.

The most serious statement made by Colonel Burton in his 15 April memo is that since 1984 there has been "a pattern of key BRL attempt to reduce the apparent casualties caused by the Bradley during tests."

The evidence the team examined suggests that there is a pattern of BRL methods which have had the effect of reducing the apparent casualties reported from these tests. Further investigation is required to determine whether this pattern is an intentional attempt to bias the results or is merely the natural consequence of the test methods employed by BRL.

The JLF approach was backed at the highest levels of DOD in 1984. Deputy Under Secretary Wade wrote:

"Last fall OSD proposed, and the Services unanimously agreed to the Joint Live Fire Test Program. The stated purpose of the program was to test the lethality of U.S. weapons against combat configured Soviet vehicles and to determine (and correct where possible) the vulnerabilities of combat configured U.S. vehicles to Soviet weapons. The program was concerned with two areas, aircraft and armor systems.

"**The need for this program was recognized by all**, since no current front line U.S. system (armor or aircraft except A-10) has ever been tested (through a formal test program) in a combat configuration for vuonerabilities to live Soviet weapons. **For the past twenty years, lethality/vulnerability assessments have been almost entirely based upon computer analysis with little or no full scale combat configured vehicle test results to support the assessments.**" [emphasis added] (Wade memo to Joint Logistics Commanders, 24 August 1984)

The aircraft tests have gone smoothly, but the armor tests were problematic from the beginning. The report notes a June 1984 memo from Col. Burton criticizing BRL methods in the 1984 tests.

The OSD observer of these tests confirmed many of Col. Burton's observations. The team has his four volume description of the 1984 tests, his 12 page memo to the team, and his direct testimony. None of this evidence is mentioned in the report.

The witness testified that BRL's actions almost always resulted in lessening the results of the test shots and rarely if ever resulted in more severe behind armor effects. He told the investigative team that OSD could have gotten much more information if the tests had not been conducted in this fashion. In a memo to the investigation team, this witness stated that the same shotline was used for 14 out of 15 shots in the tests and "was about the most benign shot line available anywhere in the crew compartment," avoiding all ammo, missiles, fuel and crew positions.

Citing his experience as a testing expert--he ran the most extensive anti-armor test ever conducted in peacetime in this country--the witness scoffed at Army claims that random shots at combat loaded vehicles would be too expensive. He estimated he could run the Bradley test with 6 worn out vehicles or ballistics hulls in a few months for $50 million. This would be much less expensive, he claimed, than the component testing has been. He pointed out that after nearly two decades of testing the Bradley, the modeling approach still has not yielded a reliable picture of the vehicle's vulnerabilities.

He specifically supported Col. Burton's claim that watering the dummies in the tests reduced the apparent casualties. He noted that watering the dummies (or more commonly, removing the combat fatigues from the dummies so they would not catch fire) was a minor action compared to selecting aimpoints on the vehicle which specifically avoiding hitting ammunition and fuel.

The team had an extensive interview with the BRL director of these tests. He vigorously disputed Col. Burton's statements. Specifically, he claimed that the burning dummy spoiled the test and was watered down to bettter isolate the test factors. The overall BRL rational for its methods is contained in the team's report.

The concerns of Col. Burton and the OSD observer were shared by Secretary Wade who wrote:

"In November 1983, the JTCG was asked to prepare program plans for the aircraft and armor phases. The aircraft plan was submitted in March 1984, approved and funded. It was responsive to the objectives of the program....

The armor community of the JTCG, on the other hand, has been unwilling to prepare a plan consistent with the objectives of the Joint Live Fire Test Program They have recently submitted a proposal which calls for spending $16M conducting literally thousands of preliminary tests on inert, (no fuel, no ammo, no hydraulic fluid) targets to 'characterize' warheads...etc...**This approach is not consistent with the purpose of the JLF, which is to determine the lethalities/vulnerabilities of combat configured equipment by actual test, not by modeling."** [emphasis added] (Wade memo to JTCG, 24 August 1984)

In September 1984, Secretary Wade again complained that a series of Army actions, taken together,

"...indicate a continued reluctance to conduct full scale vulnerability tests of combat configured M-2/3 vehicles, a reluctance which, quite frankly, I do not understand." ( Memorandum to the Assistant Secretary of the Army, 5 September 1984)

Secretary Wade noted in his interview with the investigative team that a compromise was worked out with the Army and the program seemed to be running well in early 1985. He called the JLFT program a "much needed step forward." He said, "the Bradley program had been heading for disaster...It took a live-fire test to get people to wake up."

The team's report notes that at present the Army has agreed to change many of its test methods in Phase II. But these methods are still used in other tests and the changes may only be temporary.

Why Not Rely on Computer Models?

The team report contains an extensive discussion of modeling. The alternative deserves equal space. Empirical evidence of the consequences of relying extensively on models follows:

"Our weapon systems today are procured with computer-based vulnerability/lethality estimates, little firing data and no live firing results. What are the consequences of not conducting realistic-combat live fire testing? When actual combat occurs, we discover, too late, serious shortcomings in our weapons systems; shortcomings which cost lives.

There are many accounts from WW II, Korea and Vietnam where U.S. "bazookas" failed to stop enemy tanks due to inadequate warheads. In WW II, Korea and Israel, U.S. tanks proved excessively flammable and vulnerable. The Israeli experience of 1973 showed that the U.S. M-60 burned or blew up twice as often when hit as the British Centurion, and more often than its predecessor, the M-48. Concern over excessive casualties caused the Israelis to make several changes to ther M-60s: different hydraulic fluid, fire extinguishers, special armor packages, etc...

In Vietnam, U.S. fighters also proved to be unnecessarily flammable and vulnerable. Fire and explosion caused the losss of at least 60 percent of the 5,000 U.S. aircraft downed in Vietnam. During the course of the war, survivability improvements kits had to be hastily developed and installed on fighters such as F-4 and F-105 to reduce their vulnerability.

In 1982, Congress directed a competitive 'shoot off' between candidate modern day bazookas to determine which one the Army would procure for tis infantrymen to kill tanks. Six candidates were tested, and a

winner was selected, the AT-4. Over 400 rounds were fired during that major competition, yet not one round was fired against an actual tank...

As a consequence of not doing combat-realistic live fire testing, we have no idea whether today's 'bazooka,' tanks or first line fighters have improved this situation. The Joint Live Fire Test Program was initiated by OSD in 1984 to answer this question and to assist in making sure real improvements happen."

(Statement by Col. James Burton to the Procurement Subcommittee, HASC, 18 February 1986)

## Conclusion

The pattern of BRL and Army actions raises fundamental questions about the realism and independence of our weapons testing.

The Research and Development Subcommittee received extensive testimony in December and January from a senior member of the professional staff indicating that the pattern revealed by the Bradley test is not unique. He testified that, "the test and evaluation process is seriously flawed when the Pentagon repeatedly obligates millions and in some cases billions of dollars in defense appropriations before we find that the system does not work."

The investigation team report, taken together with these additional views, should be cause for concern. Since the Committee relies so heavily on test reports when considering its authorizations, the Committee should consider both an extensive GAO investigation and a series of Committee hearings on the reliability of test methods and practices currently in use.

Joseph Cirincione, HASC Staff

## INTERVIEWS

### Office of Secretary of Defense

Honorable James Wade, Under Secretary of Defense for Acquisition and Logistics (Previous job, Under Secretary of Defense for Research and Engineering)

Dr. Joseph Navarro, Deputy Under Secretary of Defense for Test and Evaluation.

Mr. Charles Watt, (Previous job) Acting Deputy Under Secretary of Defense for Test and Evaluation

Brigadier General Don Jones, Deputy Director for Test and Evaluation

Colonel James Burton, Director, Joint Live Fire Test Program

### Department of Army

Honorable James Ambrose, Under Secretary of the Army

Mr. Walt Hollis, Deputy Under Secretary of the Army for Operations Research

Lieutenant General Louis Wagner, Deputy Chief of Staff for Research, Development and Acquisition

Lieutenant General Quinn Becker, the Surgeon General of the Army

Major General Garrison Rapmund, Assistant Surgeon General for Research and Development

Brigadier General Claude Donovan, Project Manager, Light Combat Vehicles

Brigadier General Jerry Harrison, Deputy Director, Weapon Systems, Office of the Chief of Staff for Research, Development, and Acquisition

Dr. Richard Vitali, Director, LABCOM, Ballistics Research Laboratory

Colonel William Coomer, Project Manager, Bradley Fighting Vehicle

Mr. Gary Holloway, Ballistics Research Laboratory

Mr. Raymond Pollard, Army Material Systems Analysis Agency

Lieutenant Colonel Raymond Kaufman, Department of Army System Coordinator, Office of Chief of Staff for Research, Development, and Acquisition

Mr. Peter Pritchard, Test Director, TECOM

GAO

Mr. Henry W. Connor, Associate Director, National Security and International Affairs Division

Mr. Hyman S. Baras, Group Director, National Security and International Affairs Division

Ms. Beverly Breen, Evaluator

Institute for Defense Analysis

Dr. Lowell Tonnessen

Dr. Gordon Smith (formally, IDA)

Mr. Robert G. Dilger, Mapleknoll Associates, formerly, Consultant to Institute for Defense Analysis

THE SECRETARY OF DEFENSE

WASHINGTON THE DISTRICT OF COLUMBIA

14 MAR 1986

Honorable Les Aspin
Chairman, Committee on Armed Services
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

The attached unclassified version of the results of the Phase I tests of the Bradley Fighting Vehicle is submitted as required by the 1986 Authorization Act to supplement the classified version forwarded by my memorandum of 17 December, 1985.

Sincerely,

Attachment

PHASE I - RESULTS OF THE SURVIVABILITY TESTING AND
ANALYSIS PROGRAM FOR THE BRADLEY FIGHTING VEHICLE SYSTEM

I. INTRODUCTION

A. PURPOSE: The purpose of this report is to address the issues raised in the 17 June 1985 Congressional Record and Secretary of Defense Report to the Armed Services Committee (House and Senate) concerning the survivability testing for the Bradley Fighting Vehicle System.

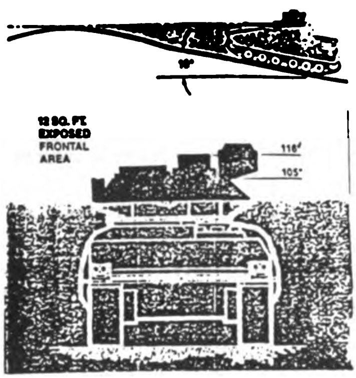
B. BACKGROUND: The Bradley Fighting Vehicle (BFV) provides the Army the mechanized infantry part of the combined arms team employing armor, infantry, artillery, and attack helicopters operating in concert. The BFV also provides the armored cavalry units a vehicle for their screening, reconnaissance, and security missions. Both the infantry fighting vehicle (IFV) and the cavalry fighting vehicle (CFV) have a two-man turret in which are mounted the 25mm automatic, stabilized cannon, the TOW anti-tank guided missile system, and the 7.62mm coaxial machinegun. The IFV has, in addition, six 5.56mm firing port weapons positioned along the side and rear of the vehicle for the remaining six members of the nine man squad. The CFV, in addition to driver, gunner and commander, also carries two scouts for dismounted reconnaissance. The overall mobility of the vehicles is comparable to that of the M1 tank. The vehicles' commanders and gunners are provided with day and night thermal sights and the drivers have image intensification night vision capability.

An armored vehicle's survivability has several components. These are its integral armor, the lethality of its on-board weapons and its operational employment concept. Bradley on-board weapons are discussed above. The integral armor protection levels and a brief description of employment concepts are discussed below.

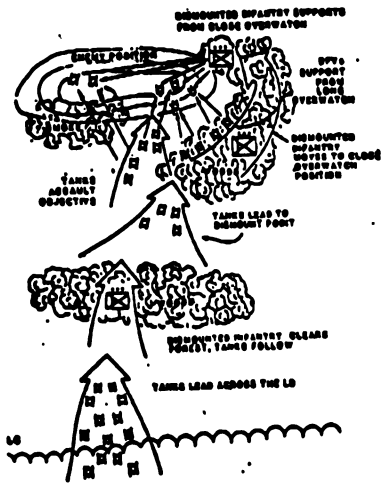
1. The Materiel Need Statement for the BFVS specified that Bradley would provide protection from small arms and 14.5mm automatic cannon ammunition, certain antitank mines, and artillery attack. These threat munitions were tested against the Bradley during DT II.

2. The operational employment concepts for Bradley in defensive and offensive operations are as follows:

a. In defensive operations the key element in survivability against the attacking enemy's weapons is the proper use of terrain. As can be seen in the first illustration to the right, very little of the BFV is exposed when firing the 25mm gun or the TOW from a defensive position.




b. Offense is the means by which the attacker carries the battle to the enemy and destroys his will to fight. The BFV's firepower, and ability to shoot on the move and at night makes the mechanized infantry a contributing member of the combined arms team. In the offense, tactics play a major role in BFV survivability. As can be seen in the second illustration at the right, terrain and the enemy situation causes the BFVs to operate differently with the rest of the combined arms team. This illustration shows tanks leading, dismounted infantry leading and BFVs supporting by fire.



c. A more detailed discussion on the employment of the BFV can be found in US Army Field Manual 71-2J and Field Circular 7-7J.

The operational employment of the Bradley requires tactical operation in an environment where anti-armor weapons capable of defeating the tank will be present. The presence of these over-matching weapons (greater than the system was designed to withstand) have resulted in the Army

initiating an extensive study of Bradley survivability. Analytical studies were conducted in 1983 as part of the Block II improvement program. These studies showed potential enhancements could be achieved through changes in armor or design modifications and through improved lethality of on-board weapons (i.e. destroy the Threat before it has a chance to attack). This effort re-confirmed the Ballistic Research Laboratory's original findings that the two principal hazards are fuel and ammunition stored inside the vehicle.

Discussions of a Bradley Vulnerability Test Program began early in 1984 and culminated in an agreed test program in September 1984. This program is structured in two phases:

Phase I: Analysis of threat and testing of vulnerability to overmatch weapons and,

Phase II: Development of survivability enhancements and prove-out through live-fire tests, and improvement and verification of vulnerability models.

C. SCOPE: This report focuses on the Phase I portion of the Survivability Enhancement Program. Results of the actual live-fire testing and preliminary analysis of potential survivability enhancements are presented. This report also contains the results of live-fire testing of the Soviet BMP and US M901 (ITV) conducted to provide comparative data for vehicles with similar missions.

## II. PHASE I VULNERABILITY TESTS

### A. THREAT SELECTION

1. Table I identifies the threat weapons that are most likely to be employed against the Bradley. Testing and assessment of those threats tested in DT II were not repeated in this test series.

TABLE I - BFVS THREAT WEAPONS

| CLASS | SIMULANT | REMARKS |
|---|---|---|
| Small Arms (7.62mm - 12.7mm) | | Tested in DT II |
| Automatic Cannons (14.5mm - 30mm) | UK 30mm APDS | 14.5mm tested in DT II |
| Light Antiarmor Weapons Rocket Propelled Grenades (RPG) 73mm Cannon | LAW/RPG-7G | |
| Tanks (100mm, 115mm, 125mm HEAT and KE) | German 120mm HEAT | |
| ATGM'S | TOW | |
| Artillery | | |
| Overhead | 155mm VT | Tested in DT II |
| Direct Fire | German 120mm HEAT | |
| Mines | | |
| Blast/Frag | Soviet TMN-46 | Tested in DT II |
| | USM16A1 | Tested in DT II |
| Antitank | US M718 | |

2. As stated previously, it was recognized that it would not be possible to test every threat munition under every possible impact condition. Data was gathered from hits under enough representative conditions to allow reasonable extrapolations to conditions that were not tested. The combinations of threat munitions and impact conditions (i.e., aim points, attack angle, and striking velocity) were selected to address concerns about specific munition damage mechanisms and vehicle component failure modes and to explore areas of uncertainty. Aim points, for which the resultant damage was known with a high degree of certainty, were excluded. This approach, which excluded certain minor damage and catastrophic explosion shots, was used to gather the maximum amount of information within the time, cost and manpower resources available.

D. THREAT MUNITIONS

1. A total of 68 shots were fired against the BH&T and the production M3's. Twenty-two of these shots were against the BH&T; thirty-six were against combat-loaded M3's containing inert ammunition; and the final ten shots were against combat-loaded M3's containing live ammunition. The distribution of shots by munition type and target condition is given below:

| | | COMBAT LOADED M3'S WITH: | |
|---|---|---|---|
| | BH&T | INERT AMMUNITION | LIVE AMMUNITION |
| RPG-7G | 0 | 13 | 6 |
| TOW-STATIC | 3 | 0 | 2 |
| TOW-DYNAMIC | 0 | 8 | 1 |
| 120mm HEAT (German) | 1 | 0 | 1 |
| ROCKEYE II | 1 | 6 | 0 |
| M718 MINE | 2 | 4 | 0 |
| 30mm KE (UK) | 0 | 5 | 0 |
| 3.2" HEAT | 15 | 0 | 0 |
| TOTAL | 22 | 36 | 10 |

2. The RPG-7G grenades, the 120mm HEAT projectiles, and the 30mm APDS projectiles were fired from actual launchers or gun barrels. The RPG's were fired at an actual range of 20- 35m which yielded impact velocities of 140 to 147 meters per second (m/s). This was the greatest range for which the scatter of impact locations was acceptable. The 120mm HEAT projectiles were fired from a range of approximately 100m. This range plus the use of a reduced propellant charge gave a striking velocity of 894-906 m/s which corresponds to actual ranges of 875-925m. The 30mm APDS projectiles were fired from a range of 27m and had a striking velocity of 970-985 m/s. These velocities correspond to actual ranges of 1500-1650m.

3. A total of nine TOW missiles were rail launched. Striking velocities of 200 to 273 m/s were recorded; these velocities correspond to actual ranges of 600-1600m. The remaining TOWs were emplaced at the vehicle and statically detonated to ensure that the jet impacted the desired item.

4. ROCKEYE II bomblets and the M718 mines were placed above or beneath the vehicle and statically detonated. The 3.2 inch shaped charges were emplaced at the vehicle and statically detonated to ensure that the jet impacted the desired item.

E. TEST CONDITIONS AND PROCEDURES

1. M3 Cavalry Fighting Vehicle

a. All M3 vehicles were in generally good operating condition. The engine, drive train, fuel system, AFSS, ventilation, and electrical systems were operational. The turret drive, TOW launcher lift and elevation mechanisms, and 25mm gun firing circuitry functioned properly; no attempt was made to actually fire the 25mm cannon. Because none of the vehicles were delivered with Integrated Sight Units (ISU), the TOW system was inoperative. None of the vehicles had a 7.62mm coaxial machine gun installed but all had a ready box and feed chute. Metal simulants were fabricated and installed for the ISU and some of the turret radios. A limited number of shots had nonoperational radios installed.

b. As testing progressed, an attempt was made to maintain this vehicle condition. Repairs and part replacements were made on all critical components damaged during any test, and to the extent possible, on all damaged non-critical components.

c. Two remotely operated auxiliary fire extinguishing systems were available. A $CO_2$ system was present for all tests in which there was a high risk of a catastrophic fire. It was used only once. For the last eight shots with live on-board ammunition, a water/aqueous foam system was also present. This system was not used in any of the tests. A standby fire truck and hand-held fire extinguishers were also available for all vehicle tests with inert ammunition. The auxiliary fire extinguishing systems were intended to be used only when it was certain that the fire would not self-extinguish, that major damage was confirmed and that, with maximum test information in hand, the priority became to retain a target vehicle for subsequent shots. The hand-held extinguishers were used to put out minor fires that could be easily extinguished by the crew in a combat situation.

d. The M3's were loaded with the equipment and supplies normally carried into combat. Preheated diesel fuel (140-150 gallons) was loaded into the fuel cells; fuel temperatures ranged from 156 degrees Fahrenheit to 160 degrees Fahrenheit in those M3 firings where a fuel cell was perforated (i.e., fuel temperatures to be expected in desert operations when the ambient temperature is between 100 degrees Fahrenheit and 120 degrees Fahrenheit). Plywood mannequins in Battle Dress Uniforms were placed in all crew positions. Combat Vehicle Crewmen (CVC) helmets were placed on the mannequins for all

shots against M3s with live ammunition. Body armor was not used in any of the tests because its use is not standard in all operational units. All combustible materials normally carried inside the Bradley were also stowed in the vehicle. All hatches were closed prior to each shot.

e. For the first thirty-six M3 shots, inert ammunition was loaded in the vehicle. A full complement of live ammunition was loaded aboard the M3 vehicles during the last ten shots with the exception of the ammunition stowed in the left exterior stowage box. This box contains all of the 5.56mm and some of the 7.62mm ammunition carried on the M3 and was removed for the last eight shots to provide an opening through which a fire hose could be inserted into the vehicle. Fuzes on all explosive items were inerted to minimize the hazard to damage assessment personnel. The Army has near term separate testing scheduled to examine the relative sensitivity with live fuzed 25mm HE ammunition. All ammunition was loaded into its normal stowage container and stowed in accordance with the M3 stowage diagram.

2. BALLISTIC HULL AND TURRET (BH&T)

a. The BH&T (PV 107) used in these tests is the same vehicle that was used for the Bradley UT II vulnerability test. It was used for two series of tests. The first series consisted of eight shots designed: to evaluate the capability of the AFSS to extinguish fuel fires, to provide an indication of the structural damage that could be expected from large caliber munitions, and to examine the level of violence from TOW flight motor reactions. The second series consisted of fourteen 3.2 inch shaped charge firings to determine the level of violence associated with 25mm ammunition reactions.

b. In the first series, mannequins with BDU's were placed in the turret and, in some instances, in the driver's seat. Only a few boxes of dummy 25mm ammunition and TOW missile tubes were stowed in the BH&T because of the lack of stowage racks. All operable hatches on the BH&T were closed prior to each shot.

c. In the second series, the 3.2 inch shaped charge was fired through the left side of the vehicle into a 25mm ammuniton box on the left sponson. The warhead was positioned so that the jet impacted the projectile along its longitudinal axis. The type (KE or HE) and quantity of rounds were varied within the box to determine their affect on the level of reactions.

3. <u>INSTRUMENTATION</u>

a. Thermocouples were placed at each of the personnel locations for most of the M3 tests. Two thermocouple probes were placed near each mannequin: one at waist level and one at head level. In addition, the temperature of the fuel in the upper cell was monitored with a thermocouple.

b. In the first series of BH&T tests, a thermocouple was used to measure fuel temperature. In the second series, thermocouples were placed at seat level in the driver's, commander's, and squad areas.

c. In the second series of BH&T tests, pressure versus time measurements were also taken. Gages were placed in the ceiling near the driver's and commander's seats and in the right rear firing port block in the squad area.

d. Beginning with shot eleven, foil pressure gages were placed in the driver's compartment, squad compartment, and turret basket on the M3's. These gages were used on most shots to determine whether blast overpressure was a serious hazard to personnel. Shock effects were assessed as part of a detailed post shot physical inspection.

e. Movie and video cameras were used on all tests. Video cameras were also placed inside the M3 vehicles containing live ammunition.

f. Sky screens or break screens were used to measure the speed of all dynamically fired munitions.

4. DAMAGE ASSESSMENT

a. After each firing, an assessment team inspected the vehicle to determine the nature and the extent of damage which occurred on that individual firing. All damage to the vehicle, individual components, and mannequins was photographed and recorded on a standard set of post-shot damage assessment forms. On the M3 firings, functional checks were made of the power pack, turret, TOW launcher, 25mm gun, and automatic fire suppression system. Because of the condition of the BH&T, only the AFSS could be checked after the BH&T firings.

b. Probabilities of incapacitation for each crew member were calculated based on the damage to the corresponding mannequin. The incapacitation estimates used by the Army assume single level hearing protection by crew/squad members in each vehicle in accordance with standard operating procedure. This being so, the assessed casualties, verified by the Army Surgeon General's Office, do not include ear drum rupture casualties due to blast/overpressure.

c. Once the incapacitation estimates were made and the components/systems that were rendered partially or completely non-functional had been identified, a Standard Damage Assessment List was used to relate the damage to each critical component to the overall degradation in the combat utility of the Bradley in accordance with conventional armored combat vehicle defeat criteria of Mobility (M), Firepower (F), and Catastrophic (K) Kill.

F. FINDINGS

Principle findings are summarized below for each major issue.

1. Capability of the Automatic Fire Suppression System.

a. The AFSS is effective in extinguishing fuel fires. The upper or lower fuel cell was perforated by the main penetrator or spall in six BH&T shots and in six M3 shots. Two of the BH&T shots were assessed as "No Test" due to errors in the test setup. Results for the remaining 10 shots are summarized below:

| Target Vehicle | No. of Rounds | No. of Fuel Fires | % Extinguished |
|---|---|---|---|
| BH&T | 5 | 4 | 100 |
| M3, Inert Ammo | 3 | 2* | 50 |
| M3, Live Ammo | 2 | 2 | 100 |
| TOTAL: | 10 | 8 | |

* One fire extinguishged by AFSS; other fire self-extinguished and did not cause any damage.

b. AFSS components were damaged in 19 of the 46 M3 firings; most frequently by spall impacts on cables and blast/shock damage to sensors.

c. The AFSS failed to discriminate (i.e., Halcn bottles discharged even though there was no fire) in approximately 45 percent of the shots into the volume protected by the AFSS.

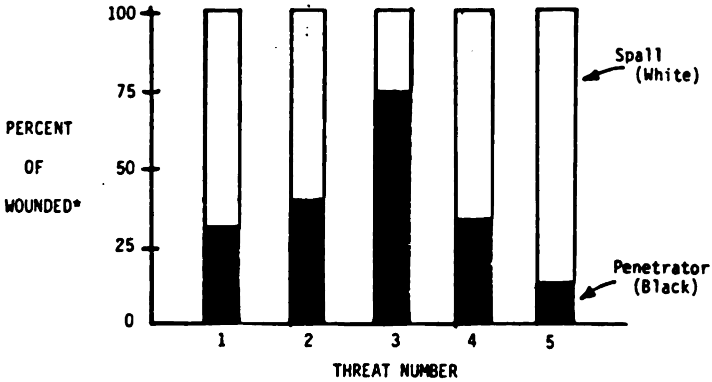
d. The discrimination rate of the AFSS, while lower than desired, erred in the proper direction. That is, it is far more preferable that the system discharge when there is no fire than fail to discharge when there is a fire. The pure Halon 1301 poses little or no health hazard to the crew at the levels that would occur during accidental discharge. The benefits of fire suppression are assessed by the Office of the Surgeon General to far out weigh the health risk from Halon 1301 and its combustion products and its use is consistent with the National Fire Protection Association (NFPA) Code for commercial applications. When the AFSS bottles do discharge, crews are trained to first don their protective mask and then evaluate the severity of any fire. Given that no fire is observed, the crews will remain masked inside the vehicle. A revised AFSS will be part of the proposed enhancements tested in Phase II.

2. Secondary fires posed no threat to the vehicle or crew.

3. Effects of Primary Penetrator, Spall, and Other Damage Mechanisms.

a. The main penetrator and spall were responsible for all casualties except one. Casualties ranged from minor wounds, requiring no immediate aid, to fatalities. The percentage of wounds due to primary penetrator and spall are shown

on the following table. One other casualty occurred on a shot in which blast blew the engine access panels into the driver. Based on the mannequin assessments, over half the crew would not have been injured in the vast majority of the M3 tests.




*Based on actual test shots and may not be representative of tactical distributions.

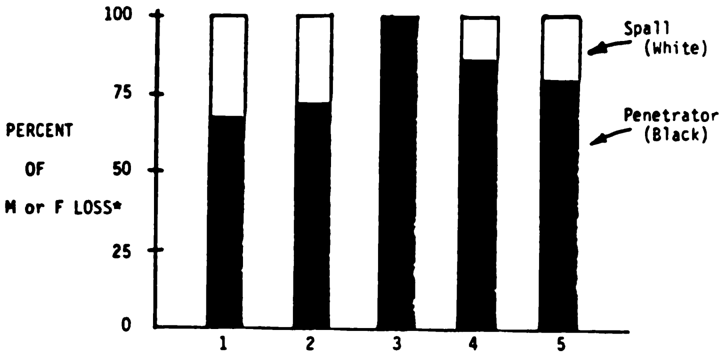
The above values exclude those casualties caused by main penetrator impacts on ammunition. Effects of these impacts are addressed below.

b. The overpressures and thermal pulses produced by the jet perforating the vehicle armor (i.e., the "vaporific effect") were not of sufficient magnitude to produce casualties. In an earlier study (supported by the Office of the Surgeon General) of vaporific effects in the M2, blast effects outside the spall cone were not observed to cause any significant injuries. Eardrum rupture would occur but the risk of a casualty from such an occurrence is felt to be low. Importantly the Office of the Surgeon General agrees, that the use of ear plugs or the standard CVC helmet should prevent eardrum rupture in soldiers. The temperatures recorded in the M3 tests did not endure long enough to produce second degree burns.

c. Direct hits by the primary penetrator on explosive or propellant sections of on-board ammunition pose the most significant hazard to the Bradley and its crew. Primary penetrator impacts on explosive and propellants will cause reactions ranging from small fires which self-extinguish to catastropic explosions. The level of violence of the reaction is dependent on a number of factors such as amount of energy deposited into the material by the primary penetrator, the number of rounds involved in the reaction, the configuration of the ammunition, etc.

d. Spall fragments were not found to be a significant hazard to ammunition.

e. The main penetrator was the predominant cause of mobility and firepower degradation in these tests. The percentage of the mobility or firepower loss due to penetrator and spall is shown below for each threat.




*Based on actual test shots and may not be representative of tactical distributions.

f. Electrical cables in the crew compartment were the only vehicle component frequently damaged by spall.

g. Structural damage for most of the munitions was limited to the hole produced by the main penetrator. For some of the shots with the larger munitions, structural failure of the armor did occur. Repair of this damage required depot level facilities.

4. Data base for Model Verification and Improvement

a. A number of improvements to current vulnerability models have been identified. These include a more detailed and more accurate three dimensional, computer representation of the Bradley as well as an improved characterization of jet effects on electrical system components. These improvements have been incorporated into the model for the comparisons discussed below.

b. Before comparing the model predictions and the test results, the following factors must be kept in mind. The outcome of an individual test firing is influenced by a number of variables (e.g., behind-armor spall patterns, round-to-round variation in warhead penetration and yaw, etc.) Thus, depending of the munition and impact condition, a wide range of outcomes could be observed for a given impact location if the shot were repeateo a large number of times. Vulnerability models are designed to predict the expected value of these possible outcomes and not the specific result of an individual firing.

c. As expected, large differences in the observed and predicted results for an individual firing were observed. However, the average values showed more reasonable agreement; differences between the assessed and predicted average values are given for two of the threat munitions in the following table.

| THREAT | TARGET VEHICLE | AVERAGE DIFFERENCE BETWEEN ASSESSED AND PREDICTED KILLS M | F | K |
|---|---|---|---|---|
| 1 | M3, Inert Ammo | 0.04 | 0.10 | 0.00 |
| | M3, Live Ammo | -0.39 | -0.17 | -0.34 |
| 2 | M3, Inert Ammo | 0.12 | 0.04 | 0.00 |
| | M3, Live Ammo | 0.20 | 0.00 | 0.00 |

M = Mobility Kill F = Firepower Kill K = Catastrophic Kill

d. There is reasonable agreement between the assessed and predicted values for the first threat except for the firings into vehicles containing live ammunition. Here, the lower than predicted frequency of catastrophic kills due to hits on ammunition is the principal source of the difference. Additional ammunition tests will be conducted to more fully characterize ammunition vulnerability.

e. For the second threat the assessed and predicted values are also in reasonable agreement. The greatest overall difference was between the assessed and predicted values for Mobility kills. That difference was due to a small fire which severed a fuel line causing a total loss of mobility; this damage was not predicted by the model.

III. Analysis of Survivability Enhancement Options

A. This portion of the report summarizes the analysis conducted on the survivability enhancement options.

1. The purpose of this study was to assess the impact of the proposed survivability enhancements to the Bradley Fighting Vehicle System (BFVS). The scope of the survivability enhancements in this study was limited to ballistic threats. In addition, the impact of a weight increase on the susceptibility of BFVS being hit was considered.

2. BFVS Survivability Options - The analysis herein considers the current BFVS, the base case, and a number of potential options for enhancing Bradley survivability.

The options for an enhanced survivability vehicle are additional armor, spall liners, restowage of ammunition, and the partial compartmentation of ammunition. Revised fuel flow and improvements to the AFSS would be included in the enhanced vehicle option.

3. Threat Weapons - The threat weapons which are considered below are (1) a light cannon firing armor piercing ammunition; (2) a light antitank rocket propelled grenade; and (3) a long range antitank missile.

B. The most important effort related to this analysis was the concurrent live fire testing conducted on the BFVS by BRL. With any vehicle, the range of battlefield hits include those where it is very predictable that relatively little damage will be done and those where it is very predictable that catastrophic damage will occur. The live fire test shots concentrated on impact locations which were not completely predictable in order to yield maximum information. However, the vulnerability estimates from the Ballistic Research Laboratory used in the development of the data herein, were not limited to the distribution of test shots but were comprised of all possible shots to include those with a high chance of catastrophic damage.

C. Probability of Mobility or Firepower Kill Given a Hit (PK/H)

The probability of a kill (or loss) of the mobility or firepower function was analytically calculated for the current (base case) and an enhanced Bradley. The enhancement option is as described in paragraph III.A.2. above. The following chart presents, for selected attack directions and threats, the area on each vehicle configuration in which there is at least a medium probability of loss of the mobility or firepower function. In all cases, values for the fully exposed (most vulnerable) condition are displayed. As can be seen, the reductions for the enhanced vehicle ranged from 23 percent (AT missile from front) to 100 percent (light cannon from front).

V. Summary and Phase II Testing.

A. The Army is using the information from these tests to develop and apply a series of modifications to improve soldier and vehicle survivability. Modifications being considered include: improvement in armor; the relocation of stowed ammunition; a revised fuel system; improved automatic fire extinguishing system; spall liners and the compartmentation of ammunition. These changes to Bradley show the greatest potential of enhancing survivability for our soldiers.

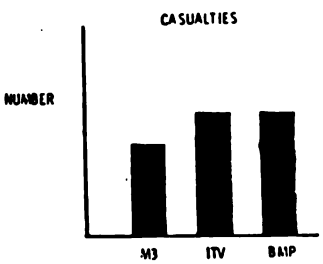
B. Phase II, to begin in Spring 1986, will test modified Bradley's against the weapons used previously in Phase I. Phase II tests will be designed to demonstrate the effectiveness of the modifications.

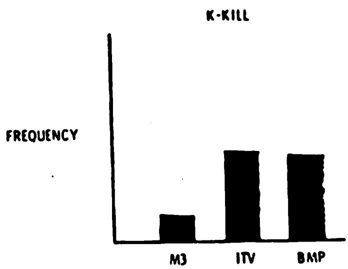
G. BMP and ITV Vulnerability Tests -

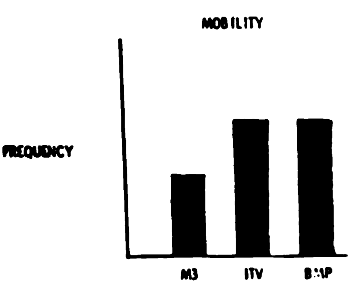
1. As stated previously, a series of live fire tests comparable to those of the Bradley were conducted on the Soviet BMP infantry fighting vehicle and the US M901 Improved TOW Vehicle (ITV).

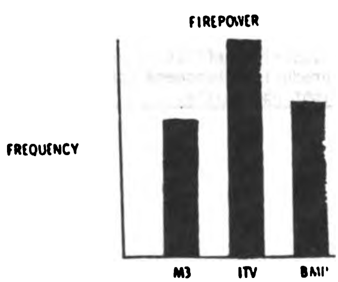
2. The ten Bradley firings were designed to examine the effects of near misses and direct jet impacts on ammunition and fuel. In laying out comparable firings on the BMP and ITV, it was not always possible to fire from the same attack direction on these vehicles due to differences in interior vehicle configuration. For example, one shot on the Bradley was from the rear into 25mm ammunition. A shot into ammunition from the same direction on the BMP would also hit fuel since the rear doors on the BMP contain integral fuel cells. Thus, the comparable shot on the BMP was fired into the left side of the vehicle.

3. Ten shots were fired against the BMP; nine shots were fired against the ITV. Both vehicles were loaded with the full complement of ammunition and supplies they carry into combat. Fuel was again preheated to simulate desert operation in a 100°F to 120°F ambient environment and loaded into the vehicles. A relative comparison of the results, again based on test firings, is shown below:



An immediate requirement exists to continue the congressional procurement initiative for an additional six C-12J aircraft in FY 1987.

Weapons Systems Upgrade

Recognizing that the ANG will of necessity be flying older, less modern aircraft into the 1990s, we believe that those older ANG aircraft should be upgraded. Upgrading of older aircraft extends the useful combat life of the aircraft and maximizes the combat potential achieved from the original investment. For example, a modified A-7, (the Strikefighter) is a cost-effective solution to the need for a close-air support/battlefield air interdiction (CAS/BAI) aircraft. It would have lower relative cost than procurement of new aircraft of equal mission capability to support the ground forces and would allow its retention in the inventory past year 2010.

Communications Equipment

ANG combat information systems units (70 percent of Total Air Force capability) and tactical air control units (60 percent of the Total Force capability) are all tasked for rapid worldwide deployment. There is an immediate requirement to procure CE&M equipment valued at approximately $66 million. This will allow procurement of the more critical items of equipment. Remaining Table of Allowances shortages and equipment modernization requirements for ANG CE&M units are in excess of $186 million.

SUMMARY

Mr. Chairman, I appreciate this opportunity to present the views of the National Guard Association of the United States on actions needed to improve the combat readiness of the National Guard.

In this statement, we have identified only the most urgent requirements. Procurement of at least a portion of the equipment discussed would begin to reduce the approximate $12 billion National Guard shortfall and would help to ensure the readiness of the National Guard to meet mission deployment objectives.

Mr. Chairman, we recognize the serious problems associated with a large budget deficit. While resources devoted to national defense must

be held to a minimum, we feel providing manpower, equipment and supporting resources necessary to maximize the wartime capability of our Guard and Reserve forces will provide the most cost-effective capability possible. We cannot afford to jeopardize national defense in the interest of economy, but we certainly must maximize our wartime capability with the resources that can be made available.

We are grateful for the support which you and the members of this subcommittee have provided in the past, and we look forward to your continued support of National Guard requirements in the future.

[Whereupon, at 2 p.m., the subcommittee recessed, to reconvene at the call of the Chair.]

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64-922 (1232)

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4. Overall, the Bradley demonstrated a greater capability than either the BMP or ITV to remain functional after being hit by representative threat munitions.

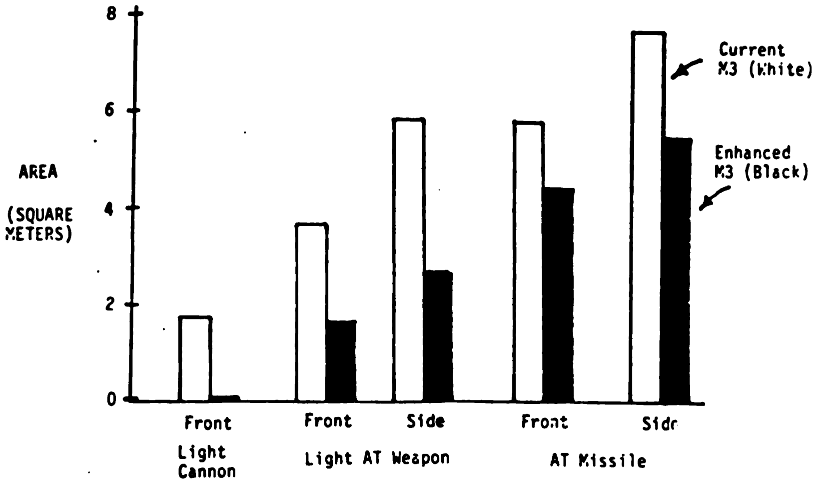
5. The Bradley demonstrated the lowest average number of wounded of the three vehicles. However, it must be remembered that the BMP carries either 11 (BMP-1) or 10 (BMP-2) personnel whereas the M3 and ITV carry only five. Allowing for the differences in crew size, the casualties for BMP and Bradley are comparable.

6. The major difference in the three vehicles was in Catastrophic Kills (K-Kill). A parallel survivability improvement program is also being pursued for ITV.

H. CONCLUSIONS

Principal conclusions from these tests are as follows:

| FINDINGS | ENHANCEMENT OPTIONS |
|---|---|
| • The AFSS successfully extinguishes fuel fires. | • Improve discrimination of the AFSS. |
| • Secondary fires are not a problem. | |
| • No spall effects on ammunition. | |
| • Jet impacts on explosives and propellants confirmed to be major hazard. | • Improve armor protection.<br>• Relocate stowed ammunition.<br>• Compartmentalize ammunition. |
| • Main penetrator and spall are major sources of damage to vehicle and crew. | • Provide spall liners for crew protection and vehicle damage.<br>• Revised the flow of fuel on the vehicle. |
| • Confirmed vaporific effect is not a casualty producing phenomena for the Bradley Fighting Vehicle. | |




D. Mobility Analysis Results - A Gap Crossing Model was used to assess the effect of increased weight on the Bradley relative to its susceptibility to being hit by opposing weapons. The results indicated that, within the weight projections, the chances that Bradley would be hit while crossing battlefield open areas increased only marginally. The analysis considered a spectrum of weapons, ranges, gap sizes and soil conditions.

E. Major conclusions of the analysis are:

1. Selective application of armor packages can substantially improve the BFVS survivability profile and reduce casualties.

2. Spall protection and restowage of ammunition is distinctly beneficial against overmatching threats.

3. Within projected weight increases the BFVS mobility degradation and resultant increase in susceptibility to being hit is very marginal. This is more than offset by the decrease in susceptibility to kill given a hit.

IV. Other Issues. As noted in the preceeding analysis, several options exist for enhancing Bradley survivability. Extensive analysis, design, and integration engineering is required to develop the best approach for improving Bradley survivability. In March 1986, live fire testing of a Bradley with proposed survivability enhancements will be conducted. After analysis of these tests, the design will be frozen in May 1986. This will allow realistic cost estimates for the survivability enhancements to Bradley. The cost data will be provided for the report to Congress on 1 June 1986.